SERVICE & OPERATING MANUAL
Original Instructions

SANDPIPER®
A WARREN RUPP PUMP BRAND

Model S20 Non-Metallic Design Level 3

See pages 2, 33 and 34 for ATEX ratings.

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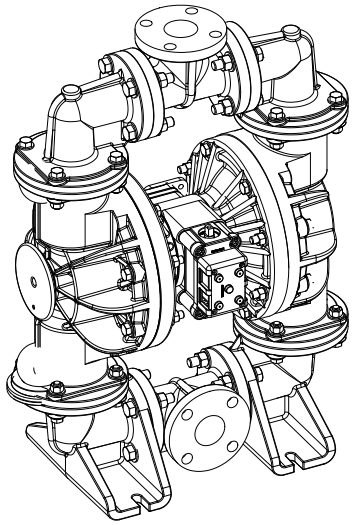
WARREN RUPP®

Quality System ISO9001 Certified

Environmental Management System ISO14001 Certified

IDEX FLUID & METERING



See pages 2, 33 and 34 for ATEX ratings.

SANDPIPER®
A WARREN RUPP PUMP BRAND

S20 Non-Metallic Ball Valve

Design Level 3

Air Operated Double Diaphragm Pump

ENGINEERING, PERFORMANCE & CONSTRUCTION DATA

INTAKE/DISCHARGE PIPE SIZE	CAPACITY	AIR VALVE	SOLIDS-HANDLING	HEADS UP TO	DISPLACEMENT/STROKE
2" Universal Flange (Fits ANSI & DIN Flange)	0 -160 US Gallons per minute (0 - 605 liters per minute)	No-lube, no-stall design	Up to .66 in. (17mm)	100 psi or 231 ft. of water (7 bar or 70 meters)	.46 US gallons (1.73 liter)

CAUTION! ***Operating temperature limitations are as follows:***

Materials	Operating Temperatures Maximum*	Minimum*
Nitrile General purpose, oil-resistant. Shows good solvent, oil, water and hydraulic fluid resistance. Should not be used with highly polar solvents like acetone and MEK, ozone, chlorinated hydrocarbons and nitro hydrocarbons.	190°F 88°C	-10°F -23°C
PVDF A durable fluoroplastic with excellent chemical resistance. Excellent for UV applications. High tensile strength and impact resistance.	250°F 121°C	0°F -18°C
NEOPRENE All purpose. Resistant to vegetable oils. Generally not affected by moderate chemicals, fats, greases and many oils and solvents. Generally attacked by strong oxidizing acids, ketones, esters, nitro hydrocarbons and chlorinated aromatic hydrocarbons.	200°F 93°C	-10°F -23°C
PTFE Chemically inert, virtually impervious. Very few chemicals are known to react chemically with PTFE: molten alkali metals, turbulent liquid or gaseous fluorine and a few fluoro-chemicals such as chlorine trifluoride or oxygen difluoride which readily liberate free fluorine at elevated temperatures.	220°F 104°C	-35°F -37°C
FKM (Fluorocarbon) shows good resistance to a wide range of oils and solvents; especially all aliphatic, aromatic and halogenated hydrocarbons, acids, animal and vegetable oils. Hot water or hot aqueous solutions (over 70°F) will attack FKM.	350°F 177°C	-40°F -40°C
Santoprene® Injection molded thermoplastic elastomer with no fabric layer. Long mechanical flex life. Excellent abrasion resistance.	275°F 135°C	-40°F -40°C
Polypropylene A thermoplastic polymer. Moderate tensile and flex strenght. Resists strong acids and alkalie. Attacked by chlorine, fuming nitric acid and other strong oxidizing agents.	180°F 82°C	32°F 0°C

For specific applications, always consult the Warren Rupp "Chemical Resistance Chart"

CAUTION: Nonmetallic pumps and plastic components are not UV stabilized. Ultraviolet radiation can damage these parts and negatively affect material properties. Do not expose to UV light for extended periods of time.

SANDPIPER® pumps are designed to be powered only by compressed air.

Maximum and Minimum Temperatures are the limits for which these materials can be operated. Temperatures coupled with pressure affect the longevity of diaphragm pump components. Maximum life should not be expected at the extreme limits of the temperature ranges.

Explanation of Pump Nomenclature
S20 Non-Metallic · Design Level 3 · Ball Valve

Model	Pump Brand	Pump Size	Check Valve Type	Design Level	Wetted Material	Diaphragm/ Check Valve Materials	Check Valve Seat	Non-Wetted Material Options	Porting Options	Pump Style	Pump Options	Kit Options	Shipping Weight lbs. (kg)
S20B3P1PPUS000.	S	20	B	3	P	1	P	P	U	S	0	00.	90 (41)
S20B3K1KPUS000.	S	20	B	3	K	1	K	P	U	S	0	00.	125 (57)
S20B3P2PPUS000.	S	20	B	3	P	2	P	P	U	S	0	00.	95 (43)
S20B3K2KPUS000.	S	20	B	3	K	2	K	P	U	S	0	00.	130 (59)
S20B3PGPPUS000.	S	20	B	3	P	G	P	P	U	S	0	00	126 (57)
S20B3KGKPUS000.	S	20	B	3	K	G	K	P	U	S	0	00	131 (59)
S20B3C1PCUS000.	S	20	B	3	C	1	P	C	U	S	0	00.	94 (43)
S20B3C2PCUS000.	S	20	B	3	C	2	P	C	U	S	0	00.	100 (45)

Note: Models listed in the table are for reference only. See nomenclature below for other models.

Pump Brand
S= SANDPIPER®

Pump Size
20=2"

Check Valve Type
B= Ball

Design Level
3= Design Level 3

Wetted Material
K= PVDF
P= Polypropylene
⚠ C= Conductive Polypropylene

Diaphragm / Check Valve Materials
1= Santoprene/Santoprene
2= PTFE-Santoprene Backup/PTFE
6= PTFE Pumping, PTFE-Neoprene Backup Driver/PTFE
B= Nitrile/Nitrile
C= FKM / PTFE
G= PTFE-Neoprene Backup/PTFE
N= Neoprene/Neoprene
Z= One-Piece Bonded/PTFE

Check Valve Seat
K= PVDF
P= Polypropylene

⚠ **Non-Wetted Material Options**
C= Carbon Filled Conductive Polypropylene
P= 40%Glass Filled Polypropylene
1= 40%Glass Filled Polypropylene w/PTFE Coated Hardware

Porting Options
U= Universal Flange (Fits ANSI & DIN)
7= Dual Porting (ANSI)
8= Top Dual Porting (ANSI)
9= Bottom Dual Porting (ANSI)

Pump Style
D= with Electronic Leak Detection (110V)
E= with Electronic Leak Detection (220V)
M= with Mechanical Leak Detection
S= Standard
V= with Visual Leak Detection

Pump Options
⚠ 0= None
1= Sound Dampening Muffler
2= Mesh Muffler
3= High temperature Air Valve w/Integral Muffler
4= High temperature Air Valve w/Sound Dampening Muffler

Pump Options continued
5= High temperature Air Valve w/Mesh Muffler
⚠ 6= Metal Muffler
⚠ 7= Metal Muffler with grounding cable

Kit Options
⚠ 00.= None
P0.= 10-30VDC Pulse Output Kit
◇ P1.= Intrinsically-Safe 5-30VDC, 110/120VAC 220/240 VAC Pulse Output Kit
P2.= 110/120 or 220/240VAC Pulse Output Kit
E0.= Solenoid Kit with 24VDC Coil
△ E1.= Solenoid Kit with 24VDC Explosion-Proof Coil
E2.= Solenoid Kit with 24VAC/12VDC Coil
△ E3.= Solenoid Kit with 12VDC Explosion-Proof Coil

Kit Options continued
E4.= Solenoid Kit with 110VAC Coil
△ E5.= Solenoid Kit with 110VAC Explosion-Proof Coil
E6.= Solenoid Kit with 220VAC Coil
△ E7.= Solenoid Kit with 220VAC Explosion-Proof Coil
△ E8.= Solenoid Kit with 110VAC, 50 Hz Explosion-Proof Coil
△ E9.= Solenoid Kit with 230VAC, 50 Hz Explosion-Proof Coil
SP.= Stroke Indicator Pins

◆ A1.= Solenoid Kit with 12 VDC ATEX Compliant Coil
◆ A2.= Solenoid Kit with 24 VDC ATEX Compliant Coil
◆ A3.= Solenoid Kit with 110/120 VAC 50/60 Hz ATEX Compliant Coil
◆ A4.= Solenoid Kit with 220/240 VAC 50/60 Hz ATEX Compliant Coil

(1) Ⓔx II 1G c T5
II 3/1 G c T5
II 1D c T100°C
I M1 c
I M2 c

⚠ Note: Pumps are only ATEX compliant when ordered with wetted material option C non-wetted material option C, pump option 0, 6 or 7, and kit option 0.

(2) Ⓔx II 2G Ex ia c IIC T5
II 3/2 G Ex ia c IIC T5
II 2D Ex c ia 20 IP67 T100°C

◇ Note: Pumps ordered with the options listed in (1) to the left are ATEX compliant when ordered with kit option P1.

(3*) Ⓔx II 2G EEx m c II T5
II 3/2 2G EEx m c II T5
II 2D c IP65 T100°C

◆ Note: Pumps ordered with the options listed in (1) to the left are ATEX compliant when ordered with kit option A1, A2, A3, or A4. Compressed Air Temperature Range: Maximum Ambient Temperature to plus 50°C.

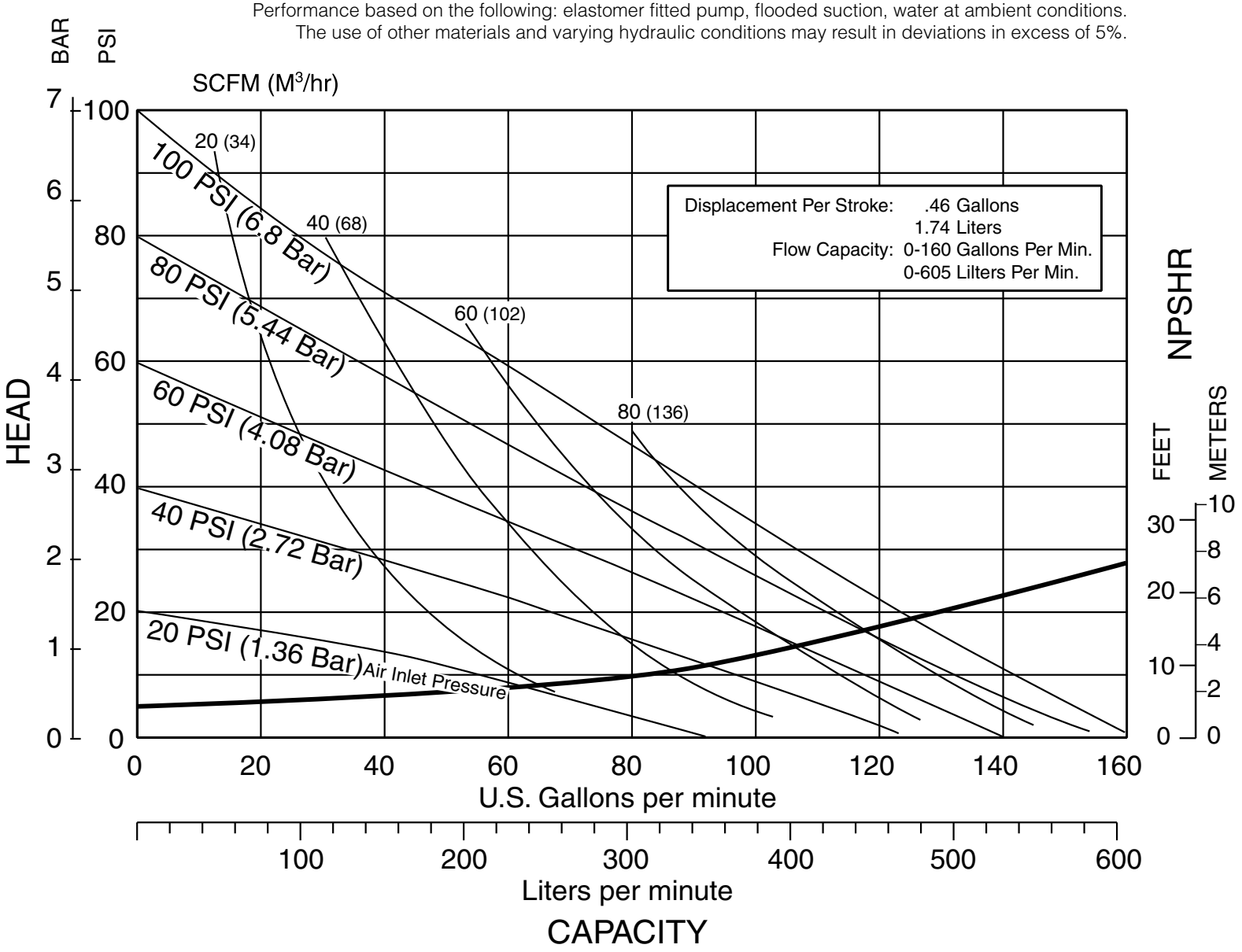
*Note: See page 20 for **Special Conditions For Safe Use**.

(4) FM APPROVED IEC EEX m T4 SA®

△ Note: Pump models equipped with these explosion-proof solenoid kit options E1, E3, E5, E7, E8 or E9, are certified and approved by the above agencies. They are NOT ATEX compliant.

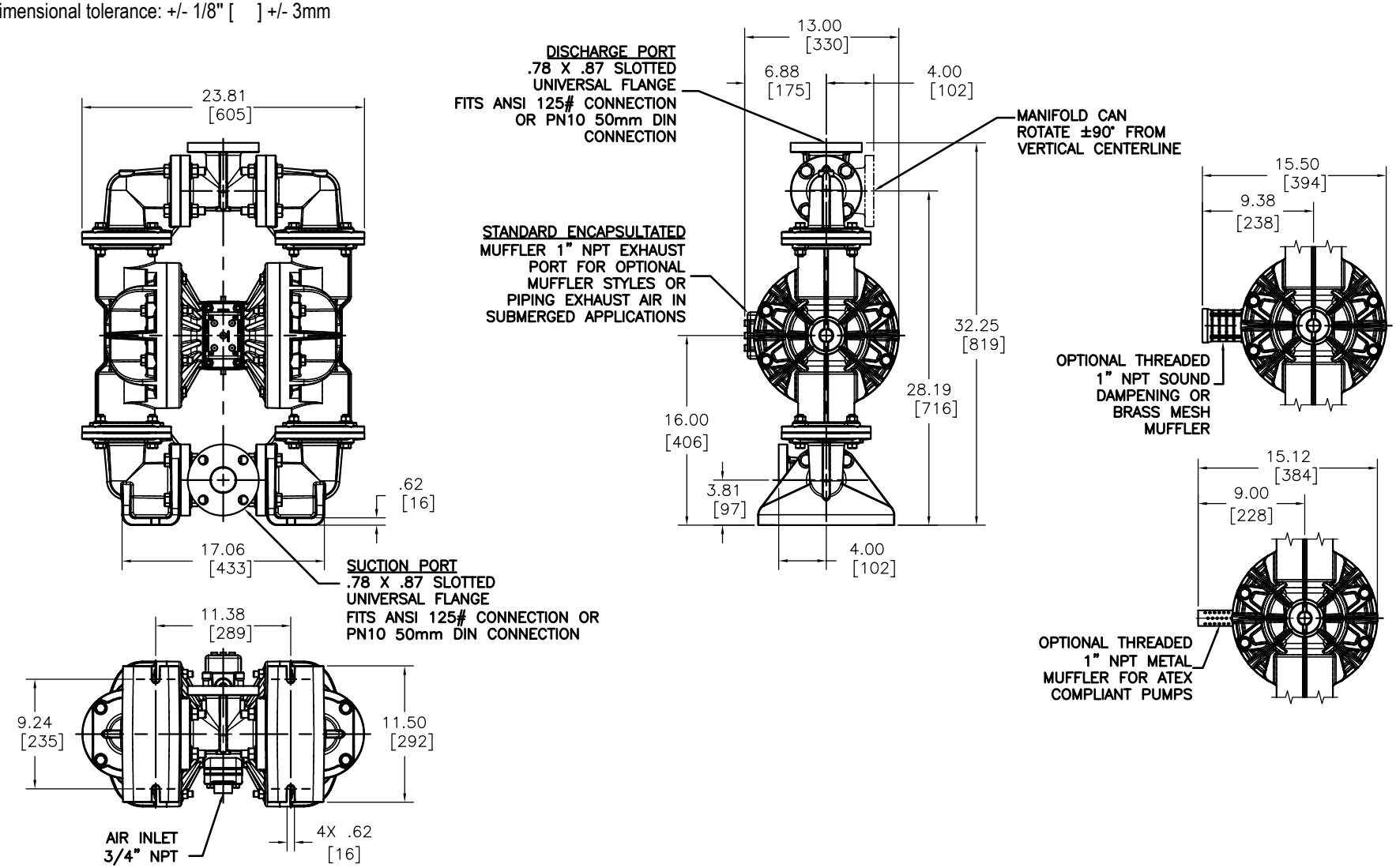
Performance Curve, Model S20 Non-Metallic Design Level 3

Performance based on the following: elastomer fitted pump, flooded suction, water at ambient conditions.
The use of other materials and varying hydraulic conditions may result in deviations in excess of 5%.



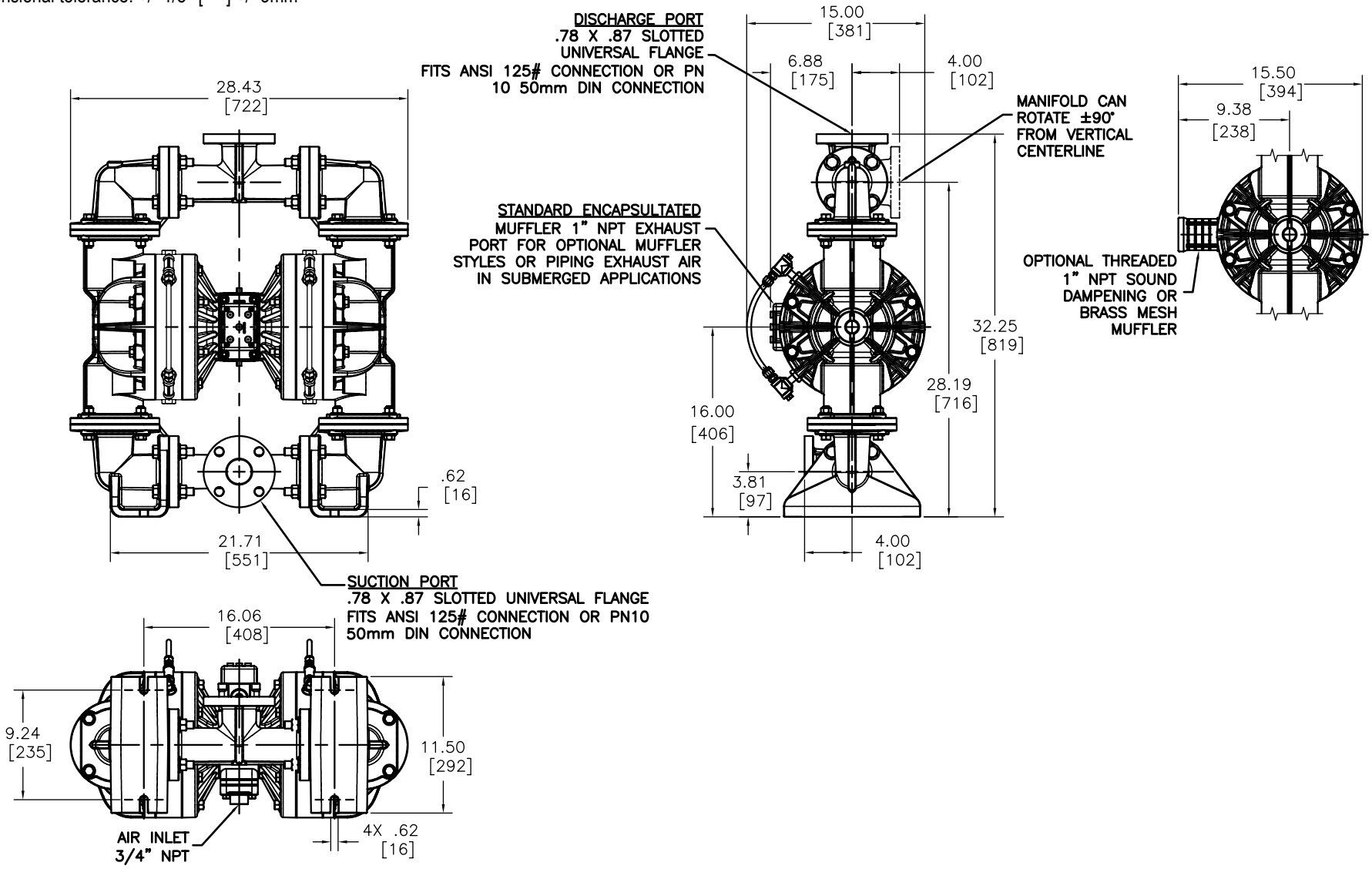
Dimensions: S20 Non-Metallic

Dimensions in Inches [ ] in Millimeters
Dimensional tolerance: +/- 1/8" [ ] +/- 3mm



Dimensions: S20 Non-Metallic with Spill Containment

Dimensions in Inches [ ] in Millimeters
Dimensional tolerance: +/- 1/8" [ ] +/- 3mm



PRINCIPLE OF PUMP OPERATION

This ball type check valve pump is powered by compressed air and is a 1:1 ratio design. The inner side of one diaphragm chamber is alternately pressurized while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod secured by plates to the centers of the diaphragms, to move in a reciprocating action. (As one diaphragm performs the discharge stroke the other diaphragm is pulled to perform the suction stroke in the opposite chamber.) Air pressure is applied over the entire inner surface of the diaphragm while liquid is discharged from the opposite side of the diaphragm. The diaphragm operates in a balanced condition during the discharge stroke which allows the pump to be operated at discharge heads over 200 feet (61 meters) of water.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device to maximize diaphragm life.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool shifts to the opposite end of the valve body, the pressure to the chambers is reversed. The air distribution valve spool is moved by a internal pilot valve which alternately pressurizes one end of the air distribution valve spool while exhausting the other end. The pilot valve is shifted at each end of the diaphragm stroke when a actuator plunger is contacted by the diaphragm plate. This actuator plunger then pushes the end of the pilot valve spool into position to activate the air distribution valve.

The chambers are connected with manifolds with a suction and discharge check valve for each chamber, maintaining flow in one direction through the pump.

INSTALLATION AND START-UP

Locate the pump as close to the product being pumped as possible. Keep the suction line length and number of fittings to a minimum. Do not reduce the suction line diameter.

For installations of rigid piping, short sections of flexible hose should be installed between the pump and the piping. The flexible hose reduces vibration and strain to the pumping system. A surge suppressor is recommended to further reduce pulsation in flow.

AIR SUPPLY

Air supply pressure cannot exceed 100 psi (7 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air supply line is solid piping, use a short length of flexible hose not less than ½" (13mm) in diameter between the pump and the piping to reduce strain to the piping. The weight of the air supply line, regulators and filters must be supported by some means other than the air inlet cap. Failure to provide support for the piping may result in damage to the pump. A pressure regulating valve should be installed to insure air supply pressure does not exceed recommended limits.

AIR VALVE LUBRICATION

The air distribution valve and the pilot valve are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference or poor quality air supplies when lubrication of the compressed air supply is required. The pump air system will operate with properly lubricated compressed air supply. Proper lubrication requires the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of SAE 10 non-detergent oil for every 20 SCFM (9.4 liters/sec.) of air the pump consumes at the point of operation. Consult the pump's published Performance Curve to determine this.

AIR LINE MOISTURE

Water in the compressed air supply can create problems such as icing or freezing of the exhaust air, causing the pump to cycle erratically or stop operating. Water in the air supply can be reduced by using a point-of-use air dryer to supplement the user's air drying equipment. This device removes water from the compressed air supply and alleviates the icing or freezing problems.

AIR INLET AND PRIMING

To start the pump, open the air valve approximately ½" to ¾" turn. After the pump primes, the air valve can be opened to increase air flow as desired. If opening the valve increases cycling rate, but does not increase the rate of flow, cavitation has occurred. The valve should be closed slightly to obtain the most efficient air flow to pump flow ratio.

BETWEEN USES

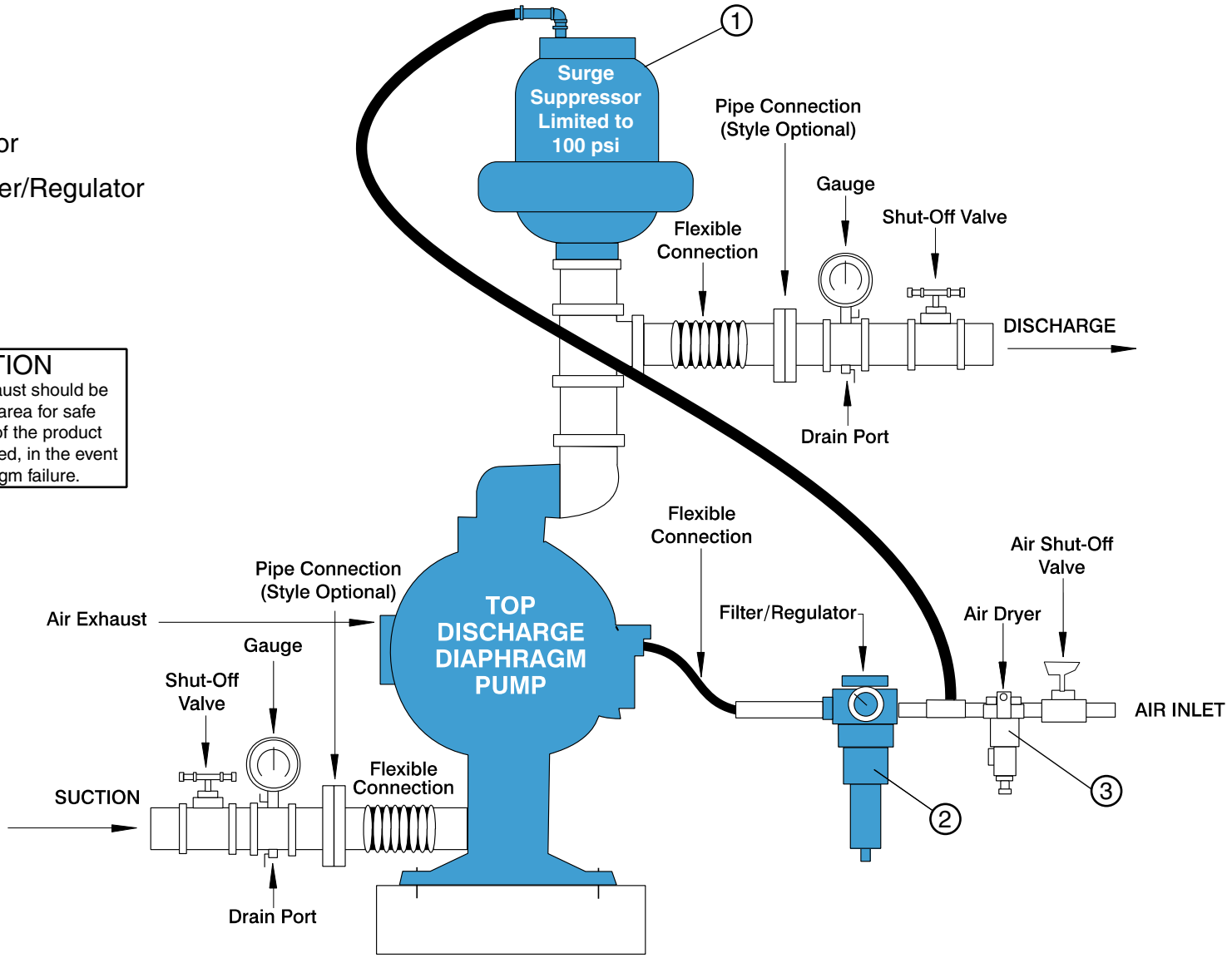
When the pump is used for materials that tend to settle out or solidify when not in motion, the pump should be flushed after each use to prevent damage. (Product remaining in the pump between uses could dry out or settle out. This could cause problems with the diaphragms and check valves at restart.) In freezing temperatures the pump must be completely drained between uses in all cases.

INSTALLATION GUIDE
Top Discharge Ball Valve Unit

Available from Warren Rupp

① Surge Suppressor
② 020-051-000 Filter/Regulator
③ Air Dryer

⚠ CAUTION
The air exhaust should be piped to an area for safe disposition of the product being pumped, in the event of a diaphragm failure.



RECYCLING

Many components of SANDPIPER® AODD pumps are made of recyclable materials (see chart on page 9 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.

IMPORTANT SAFETY INFORMATION

⚠ IMPORTANT

Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

⚠ CAUTION

Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Re-torque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.

⚠ WARNING

Before maintenance or repair, shut off the compressed air line, bleed the pressure, and disconnect the air line from the pump. The discharge line may be pressurized and must be bled of its pressure.

⚠ WARNING

In the event of diaphragm rupture, pumped material may enter the air end of the pump, and be discharged into the atmosphere. If pumping a product which is hazardous or toxic, the air exhaust must be piped to an appropriate area for safe disposition.

⚠ WARNING

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded. (See page 31)

⚠ WARNING

This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.

⚠ WARNING

When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.

⚠ WARNING

Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the air supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.

⚠ WARNING

Airborne particles and loud noise hazards.

Wear ear and eye protection.

MATERIAL CODES
THE LAST 3 DIGITS OF PART NUMBER

000	Assembly, sub-assembly; and some purchased items
010	Cast Iron
012	Powered Metal
015	Ductile Iron
020	Ferritic Malleable Iron
025	Music Wire
080	Carbon Steel, AISI B-1112
100	Alloy 20
110	Alloy Type 316 Stainless Steel
111	Alloy Type 316 Stainless Steel (Electro Polished)
112	Alloy C
113	Alloy Type 316 Stainless Steel (Hand Polished)
114	303 Stainless Steel
115	302/304 Stainless Steel
117	440-C Stainless Steel (Martensitic)
120	416 Stainless Steel (Wrought Martensitic)
123	410 Stainless Steel (Wrought Martensitic)
148	Hardcoat Anodized Aluminum
149	2024-T4 Aluminum
150	6061-T6 Aluminum
151	6063-T6 Aluminum
152	2024-T4 Aluminum (2023-T351)
154	Almag 35 Aluminum
155	356-T6 Aluminum
156	356-T6 Aluminum
157	Die Cast Aluminum Alloy #380
158	Aluminum Alloy SR-319
159	Anodized Aluminum
162	Brass, Yellow, Screw Machine Stock
165	Cast Bronze, 85-5-5-5
166	Bronze, SAE 660
170	Bronze, Bearing Type, Oil Impregnated
175	Die Cast Zinc
180	Copper Alloy
305	Carbon Steel, Black Epoxy Coated
306	Carbon Steel, Black PTFE Coated
307	Aluminum, Black Epoxy Coated
308	Stainless Steel, Black PTFE Coated
309	Aluminum, Black PTFE Coated
310	PVDF Coated
313	Aluminum, White Epoxy Coated
330	Zinc Plated Steel
331	Chrome Plated Steel
332	Aluminum, Electroless Nickel Plated
333	Carbon Steel, Electroless Nickel Plated
335	Galvanized Steel
336	Zinc Plated Yellow Brass
337	Silver Plated Steel
340	Nickel Plated
342	Filled Nylon
351	Food Grade Santoprene
353	Geolast; Color: Black
354	Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED
355	Thermal Plastic
356	Hytrel
357	Injection Molded Polyurethane
358	Urethane Rubber (Some Applications) (Compression Mold)
359	Urethane Rubber
360	Nitrile Rubber Color coded: RED
361	Nitrile
363	FKM (Fluorocarbon). Color coded: YELLOW
364	E.P.D.M. Rubber. Color coded: BLUE
365	Neoprene Rubber. Color coded: GREEN
366	Food Grade Nitrile
368	Food Grade EPDM
370	Butyl Rubber Color coded: BROWN
371	Philthane (Tuftane)
374	Carboxylated Nitrile
375	Fluorinated Nitrile
378	High Density Polypropylene
379	Conductive Nitrile
405	Cellulose Fibre
408	Cork and Neoprene
425	Compressed Fibre
426	Blue Gard
440	Vegetable Fibre
465	Fibre
500	Delrin 500
501	Delrin 570
502	Conductive Acetal, ESD-800
503	Conductive Acetal, Glass-Filled
505	Acrylic Resin Plastic
506	Delrin 150
520	Injection Molded PVDF Natural color
540	Nylon
541	Nylon
542	Nylon
544	Nylon Injection Molded
550	Polyethylene
551	Glass Filled Polypropylene
552	Unfilled Polypropylene
553	Unfilled Polypropylene
555	Polyvinyl Chloride
556	Black Vinyl
558	Conductive HDPE
570	Rulon II
580	Ryton
590	Valox
591	Nylatron G-S
592	Nylatron NSB
600	PTFE (virgin material) Tetrafluorocarbon (TFE)
601	PTFE (Bronze and moly filled)
602	Filled PTFE
603	Blue Gylon
604	PTFE
606	PTFE
607	Envelon
608	Conductive PTFE
610	PTFE Encapsulated Silicon
611	PTFE Encapsulated FKM
632	Neoprene/Hytrel
633	FKM/PTFE
634	EPDM/PTFE
635	Neoprene/PTFE
637	PTFE, FKM/PTFE
638	PTFE, Hytrel/PTFE
639	Nitrile/TFE
643	Santoprene®/EPDM
644	Santoprene®/PTFE
656	Santoprene Diaphragm and Check Balls/EPDM Seats
661	EPDM/Santoprene
666	FDA Nitrile Diaphragm, PTFE Overlay, Balls, and Seals
668	PTFE, FDA Santoprene/PTFE

Delrin and Hytrel are registered tradenames of E.I. DuPont.

Gylon is a registered tradename of Garlock, Inc.

Nylatron is a registered tradename of Polymer Corp.

Santoprene is a registered tradename of Exxon Mobil Corp.

Rulon II is a registered tradename of Dixion Industries Corp.

Ryton is a registered tradename of Phillips Chemical Co.

Valox is a registered tradename of General Electric Co.

PortaPump, Tranquilizer and SludgeMaster are registered tradenames of Warren Rupp, Inc.

TROUBLESHOOTING

Possible Symptoms:

- Pump will not cycle.
- Pump cycles, but produces no flow.
- Pump cycles, but flow rate is unsatisfactory.
- Pump cycle seems unbalanced.
- Pump cycle seems to produce excessive vibration.

What to Check: Excessive suction lift in system.
Corrective Action: For lifts exceeding 20 feet (6 meters), filling the pumping chambers with liquid will prime the pump in most cases.

What to Check: Excessive flooded suction in system.
Corrective Action: For flooded conditions exceeding 10 feet (3 meters) of liquid, install a back pressure device.

What to Check: System head exceeds air supply pressure.
Corrective Action: Increase the inlet air pressure to the pump. Most diaphragm pumps are designed for 1:1 pressure ratio at zero flow.

What to Check: Air supply pressure or volume exceeds system head.
Corrective Action: Decrease inlet air pressure and volume to the pump as calculated on the published PERFORMANCE CURVE. Pump is cavitating the fluid by fast cycling.

What to Check: Undersized suction line.
Corrective Action: Meet or exceed pump connection recommendations shown on the DIMENSIONAL DRAWING.

What to Check: Restricted or undersized air line.
Corrective Action: Install a larger air line and connection. Refer to air inlet recommendations shown in your pump's SERVICE MANUAL.

What to Check: Check ESADS+Plus, the Externally Serviceable Air Distribution System of the pump.
Corrective Action: Disassemble and inspect the main air distribution valve, pilot valve and pilot valve actuators. Refer to the parts drawing and air valve section of the SERVICE MANUAL. Check for clogged discharge or closed valve before reassembly.

What to Check: Rigid pipe connections to pump.
Corrective Action: Install flexible connectors and a surge suppressor.

What to Check: Blocked air exhaust muffler.
Corrective Action: Remove muffler screen, clean or de-ice and reinstall. Refer to the Air Exhaust section of your pump SERVICE MANUAL.

What to Check: Pumped fluid in air exhaust muffler.
Corrective Action: Disassemble pump chambers. Inspect for diaphragm rupture or loose diaphragm plate assembly. Refer to the Diaphragm Replacement section of your pump SERVICE MANUAL.

What to Check: Suction side air leakage or air in product.
Corrective Action: Visually inspect all suction side gaskets and pipe connections.

What to Check: Obstructed check valve.
Corrective Action: Disassemble the wet end of the pump and manually dislodge obstruction in the check valve pocket. Refer to the Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Worn or misaligned check valve or check valve seat.
Corrective Action: Inspect check valves and seats for wear and proper seating. Replace if necessary. Refer to Check Valve section of the pump SERVICE MANUAL for disassembly instructions.

What to Check: Blocked suction line.
Corrective Action: Remove or flush obstruction. Check and clear all suction screens and strainers.

What to Check: Blocked discharge line.
Corrective Action: Check for obstruction or closed discharge line valves.

What to Check: Blocked pumping chamber.
Corrective Action: Disassemble and inspect the wetted chambers of the pump. Remove or flush any obstructions. Refer to the pump SERVICE MANUAL for disassembly instructions.

What to Check: Entrained air or vapor lock in one or both pumping chambers.
Corrective Action: Purge chambers through tapped chamber vent plugs. PURGING THE CHAMBERS OF AIR CAN BE DANGEROUS! Contact the Warren Rupp Technical Services Department before performing this procedure. A model with top-ported discharge will reduce or eliminate problems with entrained air.

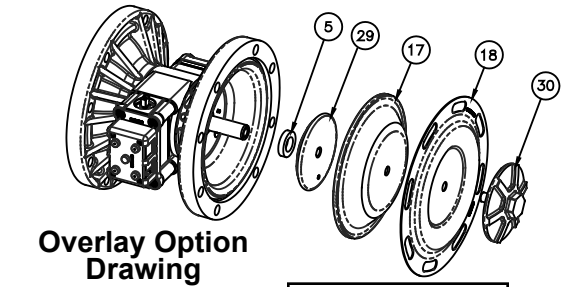
If your pump continues to perform below your expectations, contact your local Warren Rupp Distributor or factory Technical Services Group for a service evaluation.

WARRANTY

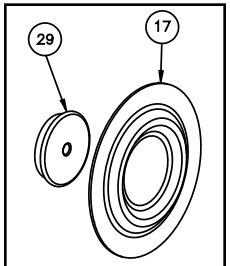
Refer to the enclosed Warren Rupp Warranty Certificate.

Composite Repair Drawing

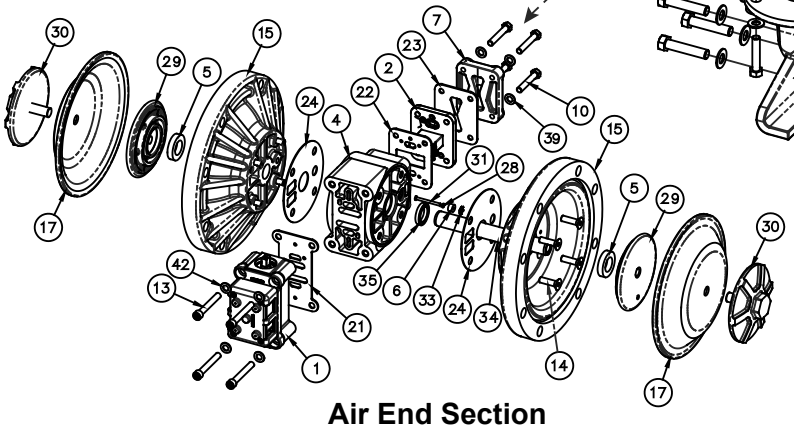
476-253-000	**AIR END KIT** Seals, O-Rings, Gaskets, Retaining Rings, Air Valve Sleeve & Spool Set and Pilot Valve Assembly
476-254-000	**AIR END KIT** **(for Stroke Indicator Option)** Seals, O-Rings, Gaskets, Retaining Rings, Air Valve Sleeve & Spool Set and Pilot Valve Assembly
476-257-354	**WETTED END KIT** Santoprene Diaphragms, Santoprene Balls and TFE Seals
476-257-360	**WETTED END KIT** Nitrile Diaphragms, Nitrile Balls and PTFE Seals
476-257-365	**WETTED END KIT** Neoprene Diaphragms, Neoprene Balls and PTFE Seals
476-257-633	**WETTED END KIT** FKM Diaphragms, PTFE Balls and PTFE Seals
476-257-635	**WETTED END KIT** Neoprene Diaphragms, PTFE Overlay Diaphragms, PTFE Balls and PTFE Seals
476-257-654	**WETTED END KIT** Santoprene Diaphragms, PTFE Overlay Diaphragms, PTFE Balls and PTFE Seals
476-258-640	**WETTED END KIT** **(For Spill Containment Pumps)** Neoprene Diaphragms, PTFE Overlay Diaphragms, PTFE Balls and PTFE Seals



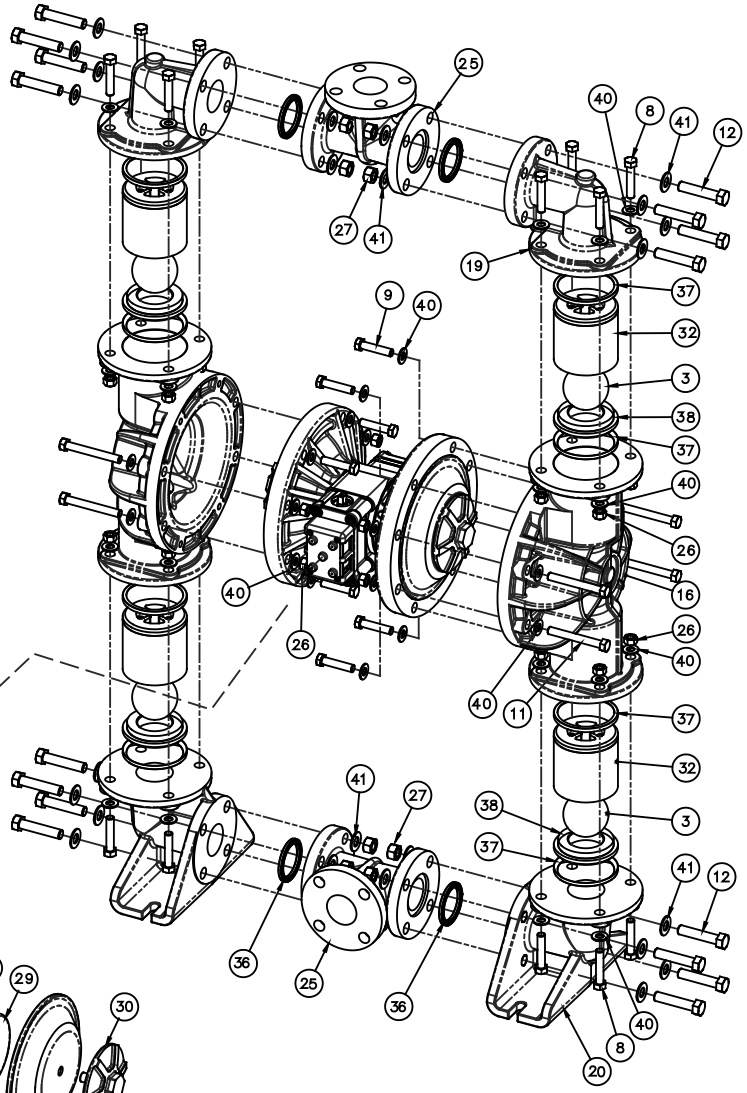
Overlay Option Drawing



One-Piece Bonded Option



Air End Section Assembly



Fluid End Section Assembly

Composite Repair Parts List

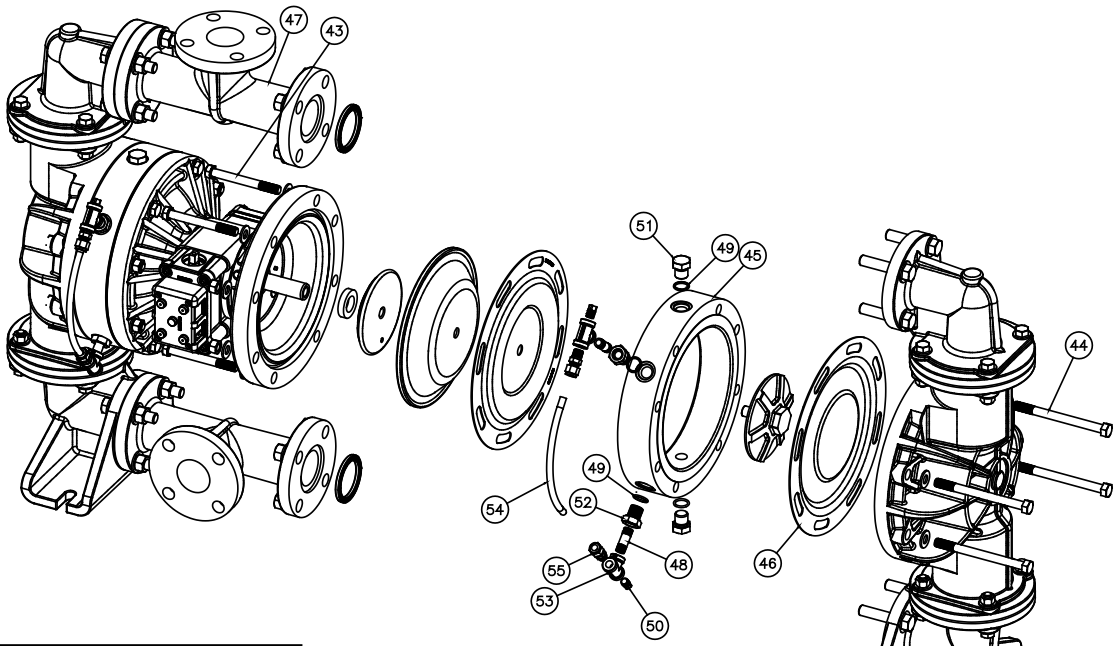
ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-140-000	Air Valve Assembly	1
⚠	031-140-001	Air Valve Assembly	
	031-140-002	Air Valve Assembly w/ PTFE coated Hardware	1
	031-141-000	Air Valve Assembly (No Integral Muffler)	1
⚠	031-141-001	Air Valve Assembly (No Integral Muffler)	1
	031-141-002	Air Valve Assembly (No Integral Muffler PTFE Coated Hardware)	1
2	095-110-558	Pilot Valve Assembly	1
3	050-038-354	Ball, Check	4
	050-038-360	Ball, Check	4
	050-038-365	Ball, Check	4
	050-038-600	Ball, Check	4
4	114-024-551	Intermediate Assembly	1
⚠	114-024-559	Intermediate Assembly	1
5	132-035-360	Bumper Diaphragm	2
6	135-034-506	Bushing, Plunger	2
7	165-116-551	Air Inlet Cap Assembly	1
⚠	165-116-559	Air Inlet Cap Assembly	1
8	170-055-115	Capscrew, Hex HD 1/2-13 x 2.50	16
	170-055-308	Capscrew, Hex HD 1/2-13 x 2.50	16
9	170-066-115	Capscrew, Hex HD 1/2-13 x 2.25	8
	170-066-308	Capscrew, Hex HD 1/2-13 x 2.25	8
10	170-069-115	Capscrew, Hex HD5/16-18 x 1.75	4
	170-069-308	Capscrew, Hex HD 5/16-18x 1.75	4
11	170-092-115	Capscrew, Hex HD 1/2-13 x 4.00	16
	170-092-308	Capscrew, Hex HD 1/2-13 x 4.00	16
12	170-015-115	Capscrew, Hex HD 5/8-11 x 2.75	4
	170-015-308	Capscrew, Hex HD 5/8-11-x 2.75	4
13	171-053-115	Capscrew, Soc HD 3/8-16 X 2.75	4
	171-053-308	Capscrew, Soc HD 3/8-16X 2.75	4
14	171-078-115	Capscrew, Flat HD 3/8-16 X1.25	8
15	196-188-551	Chamber, Inner	2
⚠	196-188-559	Chamber, Inner	2
16	196-190-520	Chamber, Outer	2
	196-190-552	Chamber, Outer	2
⚠	196-190-557	Chamber, Outer	2
17	286-005-354	Diaphragm	2
	286-005-360	Diaphragm	2
	286-005-363	Diaphragm	2
	286-005-365	Diaphragm	2
	286-114-000	Diaphragm, One-Piece Bonded PTFE	2
18	286-119-600	Diaphragm, Overlay	2
19	312-102-520	Elbow, Discharge	2
	312-102-552	Elbow, Discharge	2
⚠	312-102-557	Elbow, Discharge	2
20	312-116-520	Elbow, Suction	2
	312-116-552	Elbow, Suction	2
⚠	312-116-557	Elbow, Suction	2
21	360-093-360	Gasket, Main Air Valve	1
22	360-103-360	Gasket, Pilot Valve	1
23	360-104-360	Gasket, Air Inlet Cap	1
⚠	360-104-379	Gasket, Air Inlet Cap (Conductive Models Only)	1
24	360-107-360	Gasket, Inner Chamber	2
25	518-199-520	Manifold	2
	518-199-552	Manifold	2
⚠	518-199-557	Manifold	2
26	545-008-110	Nut, Hex 1/2-13	24
	545-008-308	Nut, Hex 1/2-13	24
27	545-009-110	Nut, Hex 5/8-11	1
	545-009-308	Nut, Hex 5/8-11	16
28	560-001-360	O-Ring	2
29	612-195-157	Inner Diaphragm Plate	2
	612-227-150	Inner Diaphragm Plate (One-Piece Bonded Option)	2
30	612-225-520	Outer, Plate Diaphragm	2
	612-225-552	Outer, Plate Diaphragm	2
31	620-004-114	Plunger, Actuator	2
32	670-046-520	Retainer, Ball	4
	670-046-552	Retainer, Ball	4
33	675-042-115	Ring, Retainer	2
34	685-063-120	Rod Diaphragm	1
35	720-004-360	Seal, U-Cup	2
36	720-038-600	Seal, Manifold	4
37	720-041-600	Seal, Check Valve Assembly	8
38	722-075-520	Seat, Check Valve	4
	722-075-552	Seat, Check Valve	4
39	901-038-115	Washer, Flat 5/16"	4
	901-038-308	Washer, Flat 5/16"	4
40	901-046-115	Washer, Flat 1/2"	48
	901-046-308	Washer, Flat 1/2"	48
41	901-047-115	Washer, Flat 5/8"	32
	901-047-308	Washer, Flat 5/8"	32
42	901-048-115	Washer, Flat 3/8"	4
	901-048-308	Washer, Flat 3/8"	4

NOT SHOWN:

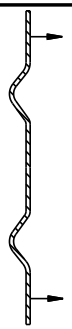
	535-010-000	Muffler	1
	530-027-000	Muffler	1
⚠	530-033-000	Muffler	1

⚠ Note: ATEX Compliant

Spill Containment Option



Note:
Items # 46 the diaphragms are to be installed with the concave side facing toward the outer chambers.



S20 Spill Containment Repair Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY
1	031-146-000	Air Valve Assembly (replaces 031-140-000)	1
	031-147-000	Air Valve Assembly (replaces 031-141-000)	1
43	170-073-115	Capscrew, Hex HD 1/2-13 x 4.50 (replaces 170-068-115)	8
	170-073-308	Capscrew, Hex HD 1/2-13 x 4.50 (replaces170-068-115)	8
44	170-102-115	Capscrew, Hex HD 1/2-13 x 6.00 (replaces 170-095-115)	8
	170-102-308	Capscrew, Hex HD 1/2-13 x 6.00	8
45	196-189-520	Chamber, Spill Prevention	2
	196-189-552	Chamber, Spill Prevention	2
46	286-120-600	Diaphragm, Pumping	2
47	518-200-520	Manifold (replaces 518-199-520)	2
	518-200-552	Manifold (replaces 518-199-552)	2
48	538-022-110	Nipple, Pipe	4
	538-022-308	Nipple, Pipe	4
49	560-078-611	O-Ring	8
50	618-003-110	Plug, Pipe	4
	618-003-308	Plug, Pipe	4
51	618-025-110	Plug, Boss	4
	618-025-308	Plug, Boss	4
52	618-031-110	Plug, Boss	4
	618-031-308	Plug, Boss	4
53	835-005-110	Tee, Pipe	4
	835-005-308	Tee, Pipe	4
54	860-055-606	Tube, Sight	2
55	866-060-110	Connector, Tube	4

SPILL CONTAINMENT CONCEPT

The spill containment option prevents the air end components from being contaminated or damaged when a pumping diaphragm ruptures while pumping caustic or toxic materials. It also helps to protect the environment. With the installation of optional leak detectors (either mechanical or electronic) the diaphragm rupture can be detected. The pump can then be shut down and repaired before any caustic or toxic materials can enter the air end and be exhausted into the surrounding environment.

OPTION DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Next shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining pumped liquid from the pump. Remove the pump before servicing.

Next, drain the fluid from the spill containment chambers. This can be done by removing the bottom plug (item 51) from each spill containment chamber.

After the fluid from the spill containment chambers has been drained, the wet end components can now be removed. See diaphragm servicing section for detailed instructions. The spill containment option has two additional virgin PTFE pumping diaphragms (item 46). These diaphragms are installed with the natural **concave** curve toward the outer chamber (items 16 from the pump assembly drawing).

FILLING CHAMBERS WITH LIQUID

THE CHAMBERS ARE FILLED WITH WATER AT THE FACTORY.

If you prefer to substitute another liquid, to prevent system contamination consult the factory first to determine compatibility of the substitute with pump construction.

Follow the steps listed here to replace the liquid in the pump after disassembly or liquid loss:

1. Drain the fluid in the spill containment chambers by removing the bottom two boss plugs (items 51). Replace the bottom two boss plugs after the fluid is drained.

2. Remove the eight capscrews (item 8) fastening the discharge manifold and elbows to the outer chambers (items 16). The discharge manifolds and elbows can now be removed.

3. Remove the top two boss plugs (items 51). The spill containment chambers are filled through the exposed ports.

4. Install safety clip (item 1-N) into the smaller unthreaded hole in one end cap (item 1-D). This locks the valve spool to one side, keeping the pump from shifting. Apply air pressure to the air distribution valve.

5. Face the side of the pump with the installed safety clip. If the safety clip is installed in the top end cap, fill the left spill containment chamber. If the safety clip is installed on the bottom end cap, fill the right spill containment chamber. The volume of fluid is 1950 ml (65.9 fl. oz.). It is important that the exact amount of fluid is used. Too little or too much fluid causes premature diaphragm failure and erratic pumping.

6. Loosely reinstall one boss plug (item 51) to the filled spill containment chamber.

7. Shut off air supply. Remove safety clip. Adjust the air line regulator so that air pressure slowly fills the pump. The diaphragm expands, forcing the fluid in the chamber to be slowly displaced. When the pump shifts to the opposite side, quickly install the safety clip.

8. Loosen the top boss plug on the filled chambers. This allows fluid in the chamber to purge trapped air from the chamber. This can be seen by watching the column of fluid in the sight tube. When fluid appears at the top of the port, quickly tighten the boss plug. Fluid loss of 1 to 2ml is acceptable.

9. Tilt the pump so the uppermost pipe tee (item 53) is in the vertical position. Loosen the pipe plug (item 50). This will allow trapped air to purge through the pipe tee. When fluid appears at the tee opening, reinstall the pipe plug.

NOTE: If all air is not purged using this procedure, remove the check valve components from the top port of the outer chamber (item 16). Apply manual pressure to the pumping diaphragm by inserting a blunt instrument into the top port of the outer chamber and applying pressure to the diaphragm. Loosen the pipe plug (item 50) allowing the fluid to purge any remaining trapped air. Reinstall the plug.

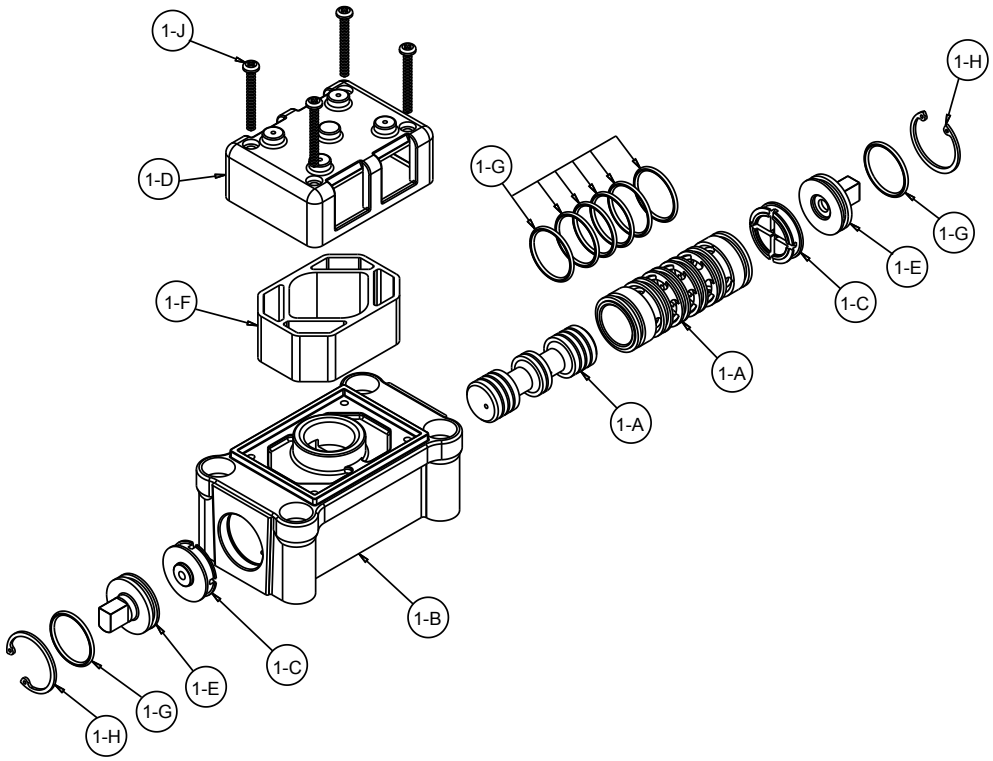
10. Repeat steps 5 through 9 to fill opposite spill containment chamber.

11. Reinstall the check valve components, discharge manifold and elbows to the pump. The pump is now ready for operation.

⚠ IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Air Distribution Valve Assembly Drawing
S20 Design Level 3



AIR VALVE ASSEMBLY PARTS LIST

Item	Part Number	Description	Qty
1	**031-140-000**	**Air Valve Assembly**	**1**
1-A	031-139-000	Sleeve and Spool Set	1
1-B	095-094-551	Body, Air Valve	1
1-C	132-029-552	Bumper	2
1-D	165-096-551	Cap, Muffler	1
1-E	165-115-552	Cap, End	2
1-F	530-028-550	Muffler	1
1-G	560-020-360	O-Ring	8
1-H	675-044-115	Ring, Retaining	2
1-J	710-015-115	Screw, Self-tapping	4

For Pumps with Alternate Mesh, Sound Dampening Mufflers or Piped Exhaust:

1	031-141-000	Air Valve Assembly	1
	(Includes all items used on 031-140-000 minus items 1-D, 1-F & 1-J)		

AIR VALVE ASSEMBLY PARTS LIST

Item	Part Number	Description	Qty
1	**031-140-001**	**Air Valve Assembly**	**1**
1-A	031-139-000	Sleeve and Spool Set	1
1-B	095-094-559	Body, Air Valve	1
1-C	132-029-552	Bumper	2
1-D	165-096-559	Cap, Muffler	1
1-E	165-115-552	Cap, End	2
1-F	530-028-550	Muffler	1
1-G	560-020-360	O-Ring	8
1-H	675-044-115	Ring, Retaining	2
1-J	710-015-115	Screw, Self-tapping	4

For Pumps with Metal Mesh Muffler or Piped Exhaust:

1	031-141-001	Air Valve Assembly	1
	(Includes all items used on 031-140-001 minus items 1-D, 1-F & 1-J)		

Note: ATEX Compliant

AIR DISTRIBUTION VALVE SERVICING

To service the air valve first shut off the compressed air, bleed the pressure from the pump, and disconnect the air supply line from the pump.

STEP #1: See Composite Repair and Parts Drawing.

Using a $^{5}/_{16}$" Allen wrench, remove the four hex socket capscrews (item 13) and four flat washers (item 42). Remove the air valve assembly from the pump.

Remove and inspect gasket (item 21) for cracks or damage. Replace gasket if needed.

STEP #2: Disassembly of the air valve.

To access the internal air valve components first remove the two retaining rings (item 1-H) from each end of the air valve assembly using clip ring pliers.

Next remove the two end caps (item 1-E). Inspect the o-rings (item 1-G) for cuts or wear. Replace the o-rings if necessary.

Remove the two bumpers (item 1-C). Inspect the bumpers for cuts, wear or abrasion. Replace if necessary.

Remove the spool (part of item 1-A) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and inspect for scratches or wear.

Inspect the inner diameter of the sleeve (part of item 1-A) for dirt, scratches, or other contaminates. Remove the sleeve if needed and replace both the sleeve and spool with a new sleeve and spool set (item 1-A).

STEP #3: Reassembly of the air valve.

Install one end cap (item 1-E) with an o-ring (item 1-G) and one bumper (item 1-C) into one end of the air valve body (item 1-B). Install one retaining ring (item 1-H) into the groove on the same end.

Remove the new sleeve an spool set (item 1-A) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-G) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body (item 1-B), align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Push the spool in until it touches the bumper on the opposite end.

Install the remaining bumper, end cap with o-ring, and retaining ring.

Fasten the air valve assembly (item 1) and gasket (item 21) to the pump.

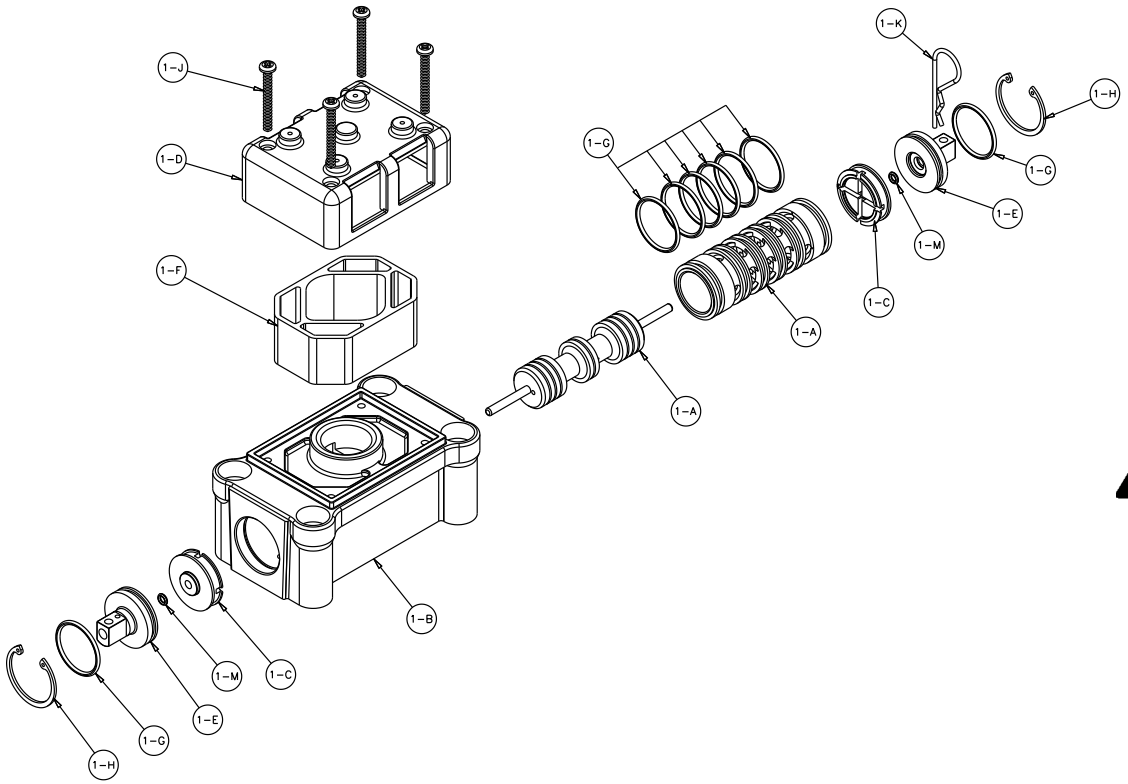
Connect the compressed air line to the pump. The pump is now ready for operation.

⚠ IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Air Valve Assembly Drawing with Stroke Indicator Option S20 Design Level 3

Note: Stroke Indicator is standard on Spill Containment models



PILOT VALVE ASSEMBLY PARTS LIST

Item	Part Number	Description	Qty
1	**031-146-000**	**Air Valve Assembly**	**1**
1-A	031-143-000	Sleeve and Spool Set w/Pins	1
1-B	095-094-559	Body, Air Valve	1
1-C	132-029-552	Bumper	2
1-D	165-096-559	Cap, Muffler	1
1-E	165-098-147	Cap, End	2
1-F	530-028-550	Muffler	1
1-G	560-020-360	O-Ring	8
1-H	675-044-115	Ring, Retaining	2
1-J	710-015-115	Screw, Self-Tapping	4
1-K	210-008-330	Clip, Safety	1
1-M	560-029-360	O-Ring	2

For Pumps with PTFE Coated Hardware:

1	031-146-002	Air Valve Assembly	1
1-J	710-015-308	Screw, Self Tapping	4

(includes all other items on 031-146-000 above)

For Pumps with Alternate Mesh, Sound Dampening Mufflers or Piped Exhaust:

1	031-147-000	Air Valve Assembly	1

(includes all items on 031-146-000 minus 1-D, 1-F, & 1-J)

Note: ATEX Compliant

AIR DISTRIBUTION VALVE WITH STROKE INDICATOR OPTION SERVICING

To service the air valve first shut off the compressed air, bleed the pressure from the pump, and disconnect the air supply line from the pump.

STEP #1: See Composite Repair and Parts Drawing.

Using a $^{5}/_{16}$" Allen wrench, remove the four hex socket capscrews (item 13) and four flat washers (item 42). Remove the air valve assembly from the pump.

Remove and inspect gasket (item 21) for cracks or damage. Replace gasket if needed.

STEP #2: Disassembly of the air valve.

To access the internal air valve components first remove the two retaining rings (item 1-H) from each end of the air valve assembly using clip ring pliers.

Next remove the two end caps (item 1-E). Inspect the o-rings (item 1-G) for cuts or wear. Replace the o-rings if necessary.

Remove the two bumpers (item 1-C). Inspect the bumper for cuts, wear or abrasions. Replace if necessary.

Remove the spool (part of item 1-A) from the sleeve. Be careful not to scratch or damage the outer diameter of the spool. Wipe spool with a soft cloth and inspect for scratches or wear.

Inspect the inner diameter of the sleeve (part of item 1-A) for dirt, scratches, or other contaminates. Remove the sleeve if needed and replace both the sleeve and spool with a new sleeve and spool set (item 1-A).

STEP #3: Reassembly of the air valve.

Install one bumper (item 1-C) and one end cap (item 1-E) with an o-ring (item 1-G) into one end of the air valve body (item 1-B). Install one retaining ring (item 1-H) into the groove on the same end. Insert the safety clip (item 1-K) through the small unthreaded hole in the end cap.

Remove the new sleeve an spool set (item 1-A) from the plastic bag. Carefully remove the spool from the sleeve. Install the six o-rings (item 1-G) into the six grooves on the sleeve. Apply a light coating of grease to the o-rings before installing the sleeve into the valve body (item 1-B), align the slots in the sleeve with the slots in the valve body. Insert the spool into the sleeve. Be careful not to scratch or damage the spool during installation. Push the spool in until the pin touches the safety clip on the opposite end.

Install the remaining bumper, end cap with o-ring, and retaining ring.

Fasten the air valve assembly (item 1) and gasket (item 21) to the pump.

Connect the compressed air line to the pump. The pump is now ready for operation.

⚠ IMPORTANT

Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Solenoid Shifted Air Valve Drawing

SOLENOID SHIFTED AIR VALVE PARTS LIST
(Includes All Items Used on Composite Repair Parts List Except as Shown)

Item	Part Number	Description	Qty
56	893-097-000	Solenoid Valve, NEMA4	1
57	219-001-000	Solenoid Coil, 24VDC	1
	219-004-000	Solenoid Coil, 24VAC/12VDC	1
	219-002-000	Solenoid Coil, 120VAC	1
	219-003-000	Solenoid Coil, 240VAC	1
58	241-001-000	Connector, Conduit	1
59	170-029-330	Capscrew, Hex HD 5/16-18 x 1.50	4
60	618-051-150	Plug	2

FM APPROVED IEC EEX m T4

△ ***For Explosion Proof Solenoid Coils used in North America and outside the European Union.***

57	219-009-001	Solenoid Coil, 120VAC 60 Hz	1
	219-009-002	Solenoid Coil, 240VAC 60 Hz	1
	219-009-003	Solenoid Coil, 12VDC	1
	219-009-004	Solenoid Coil, 24VDC	1
	219-009-005	Solenoid Coil, 110VAC 50 Hz	1
	219-009-006	Solenoid Coil, 230VAC 50 Hz	1

Note: Item 58 (Conduit Connector) is not required

For Explosion Proof Solenoid Coils used in the European Union

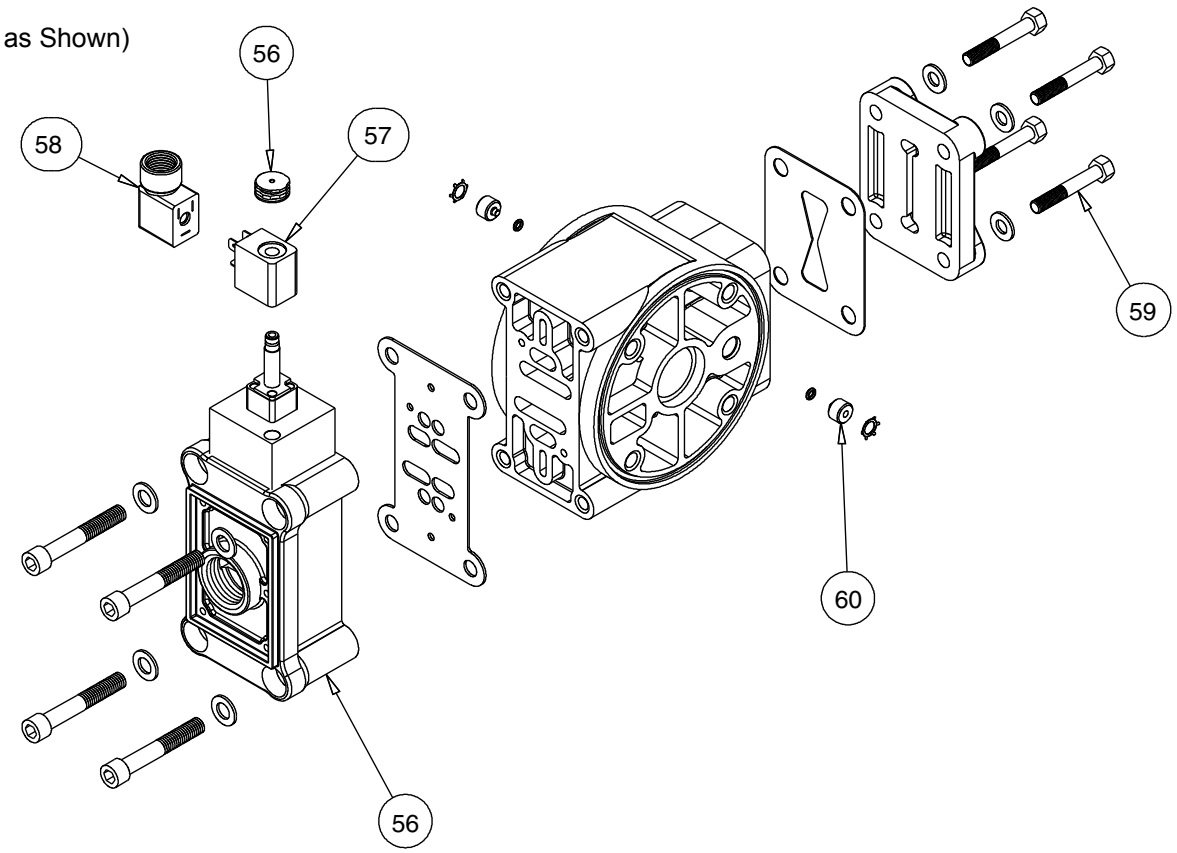
II 2G EEx m c II T5
II 3/2 G Ex m c II T5
II 2D c IP65 T100°C

*◆ ***For ATEX Compliant Solenoid Coils used in the European Union***

57	219-011-001	Solenoid Coil, Single mounting 12 VDC, 3.3W / 267mA	1
	219-011-002	Solenoid Coil, Single mounting 24 VDC, 3.3W / 136mA	1
	219-011-003	Solenoid Coil, Single mounting 110/120 VAC, 3.4W / 29mA	1
	219-011-004	Solenoid Coil, Single mounting 220/240 VAC, 3.4W / 15mA	1

Note: Item 37 (Conduit Connector) is not required

Compressed Air Temperature Range: Maximum Ambient Temperature to plus 50°C



*Special Conditions For Safe Use

A fuse corresponding to its rated current (max. $3*I_{rat}$ according IEC 60127-2-1) or a motor protecting switch with short-circuit and thermal instantaneous tripping (set to rated current) shall be connected in series to each solenoid as short circuit protection. For very low rated currents of the solenoid the fuse of lowest current value according to the indicated IEC standard will be sufficient. The fuse may be accommodated in the associated supply unit or shall be separately arranged. The rated voltage to the fuse shall be equal to or greater than the stated rated voltage of the magnet coil. The breakage capacity of the fuse-link shall be as high as or higher than the maximum expected short circuit current at the location of the installation (usually 1500 A). A maximum permissible ripple of 20% is valid for all magnets of direct-current design.

SOLENOID SHIFTED AIR DISTRIBUTION VALVE OPTION

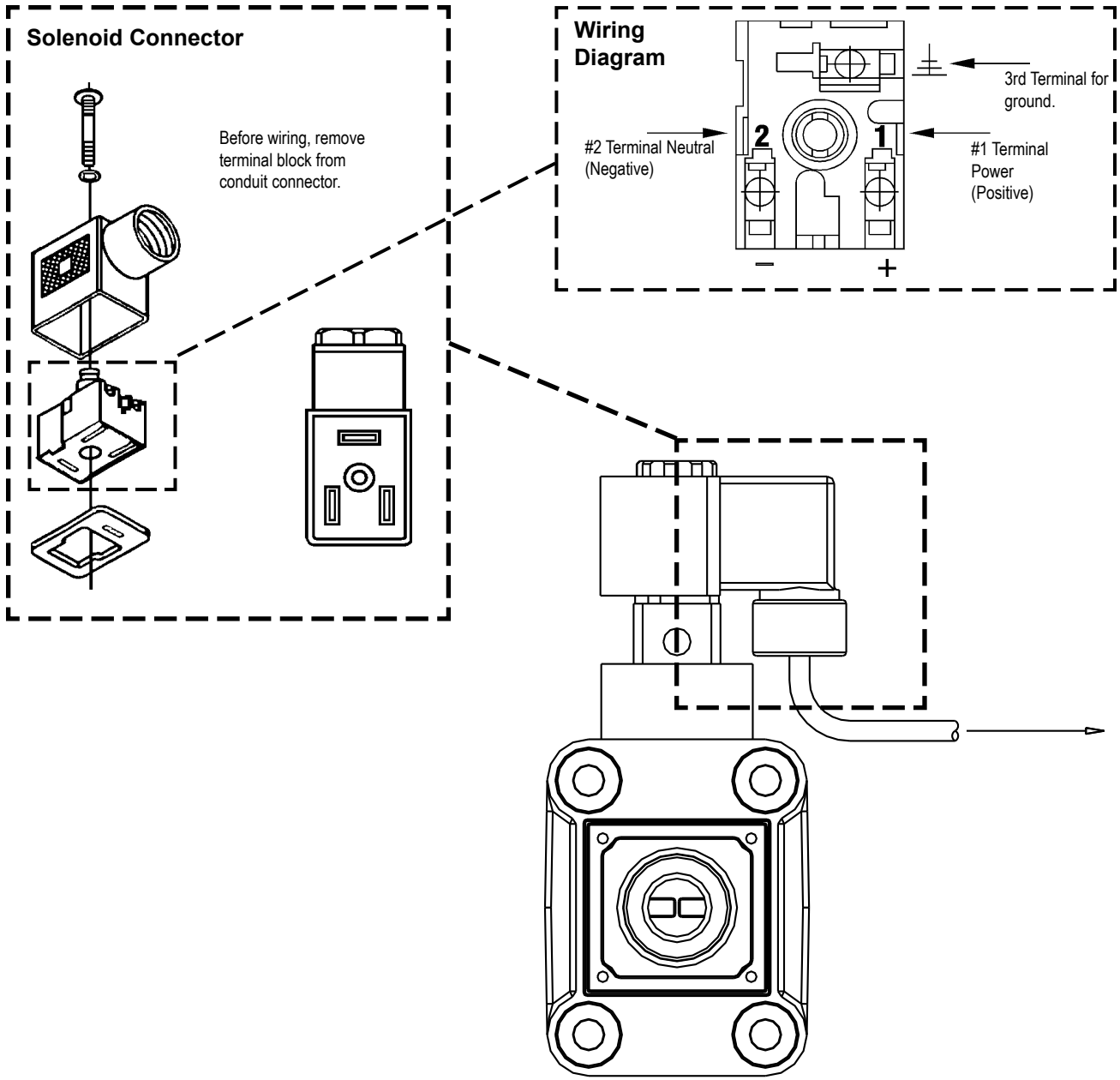
Warren Rupp's solenoid shifted, air distribution valve option utilizes electrical signals to precisely control your SANDPIPER's speed. The solenoid coil is connected to a customer - supplied control. Compressed air provides the pumping power, while electrical signals control pump speed (pumping rate).

OPERATION

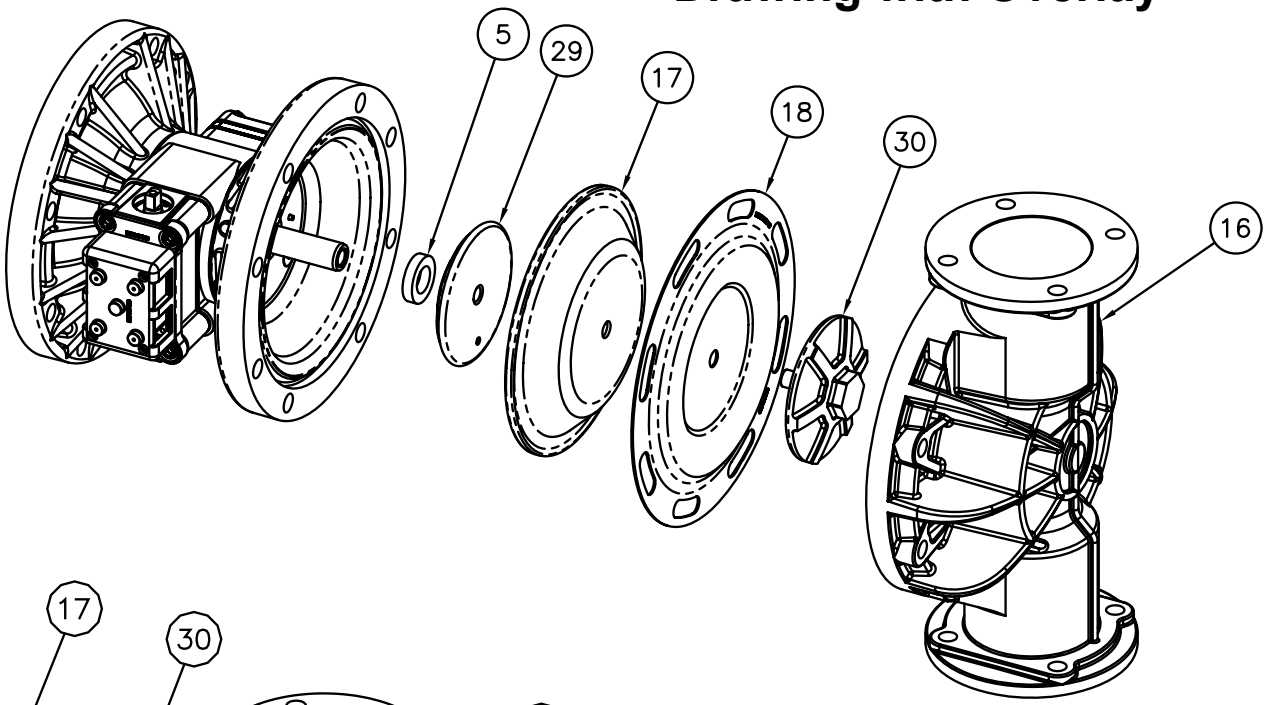
The Solenoid Shifted SANDPIPER has a solenoid operated, air distribution valve in place of the standard SANDPIPER's pilot operated, air distribution valve. Where a pilot valve is normally utilized to cycle the pump's air distribution valve, an electric solenoid is utilized. As the solenoid is powered, one of the pump's air chambers is pressurized while the other chamber is exhausted. When electric power is turned off, the solenoid shifts and the pressurized chamber is exhausted while the other chamber is pressurized. By alternately applying and removing power to the solenoid, the pump cycles much like a standard SANDPIPER pump, with one exception. This option provides a way to precisely control and monitor pump speed.

BEFORE INSTALLATION

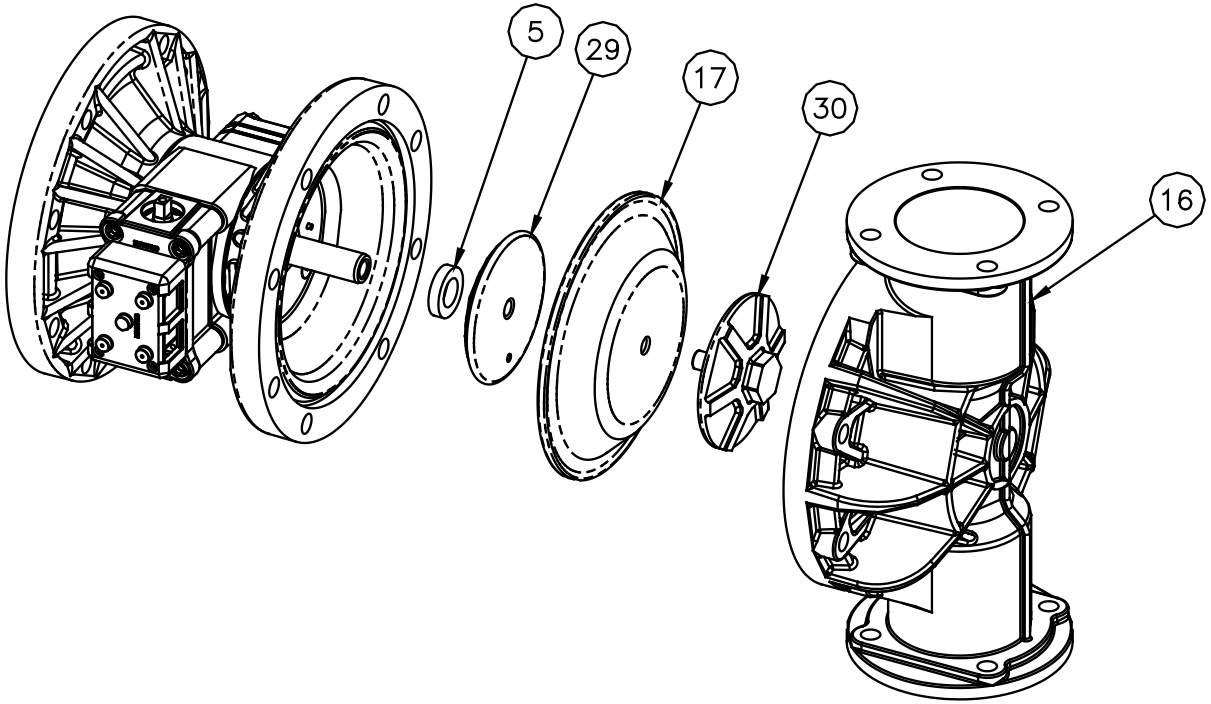
Before wiring the solenoid, make certain it is compatible with your system voltage.



Diaphragm Service Drawing with Overlay



Diaphragm Service Drawing, Non-Overlay



Field conversion kit 475-256-000 available for conversion from PTFE Overlay to One-Piece bonded Diaphragm

Part	Description	Qty
286-114-000	One-Piece Diaphragm	2
612-227-150	Plate, Inner Diaphragm	2

DIAPHRAGM SERVICING

To service the diaphragms first shut off the suction, then shut off the discharge lines to the pump. Shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining liquid from the pump.

Step #1: See the pump composite repair parts drawing, and the diaphragm servicing illustration.

Using a wrench or socket, remove the 16 capscrews (items 8), hex nuts and washers that fasten the elbows (items 19 & 20) to the outer chambers (items 16). Remove the elbows with the manifolds and spacers attached.

Step #2: Removing the outer chambers.

Using a wrench or socket, remove the 16 capscrews (items 9 & 11), hex nuts and washers that fasten the outer chambers, diaphragms, and inner chambers (items 15) together.

Step #3: Removing the diaphragm assemblies.

Use a 1½" (38mm) wrench or six pointed socket to remove the diaphragm assemblies (outer plate, diaphragm, and inner plate) from the diaphragm rod (item 34) by turning counterclockwise.

Inspect the diaphragm (item 17) for cuts, punctures, abrasive wear or chemical attack. Replace the diaphragms if necessary.

Step #4: Installing the diaphragms.

Push the threaded stud of the outer diaphragm plate through the center hole of the diaphragm. Thread the inner plate clockwise onto the stud. Use a torque wrench to tighten the diaphragm assembly together to 480 in Lbs. (54.23 Newton meters). Allow a minimum of 15 minutes to elapse after torquing, then re-torque the assembly to compensate for stress relaxation in the clamped assembly.

Step #5: Installing the diaphragm assemblies to the pump.

Make sure the bumper (item 5) is installed over the diaphragm rod.

Thread the stud of one diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 34) until the inner diaphragm plate is flush to the end of the rod. Insert rod into pump.

Fasten the remaining outer chamber (item 17) to the pump, using the capscrews (items 11 & 12), hex nuts and flat washers and tighten.

Make sure the bumper (item 6) is installed over the diaphragm rod.

Thread the stud of the other diaphragm assembly clockwise into the tapped hole at the end of the diaphragm rod (item 34) make sure the 2nd diaphragm assembly is tight enough that the inner plate is flush to the end of the rod. The bead of the end of the diaphragm should fit into the groove of the inner chamber.

Fasten the remaining outer chamber (item 16) to the pump, using the capscrews (items 9 & 11), hex nuts and flat washers.

Step #6: Re-install the elbow/spacer/manifold assemblies to the pump, using the capscrews (items 8), hex nuts and flat washers.(Ref.pg 12)

The pump is now ready to be re-installed, connected and returned to operation.

OVERLAY DIAPHRAGM SERVICING

The PTFE overlay diaphragm (item 18) is designed to fit over the exterior of the standard diaphragm (item 17).

Follow the same procedures described for the standard diaphragm for removal and installation.

One-Piece Bonded DIAPHRAGM SERVICING (Bonded PTFE with integral plate)

The one-piece bonded diaphragm (item 17) has a threaded stud installed in the integral plate at the factory. The inner diaphragm plate has a through hole instead of a threaded hole.

Place the inner plate over the diaphragm stud and thread the first diaphragm/inner plate onto the diaphragm rod only until the inner plate contacts the rod. Do not tighten. A small amount of grease may be applied between the inner plate and the diaphragm to facilitate assembly.

⚠ IMPORTANT

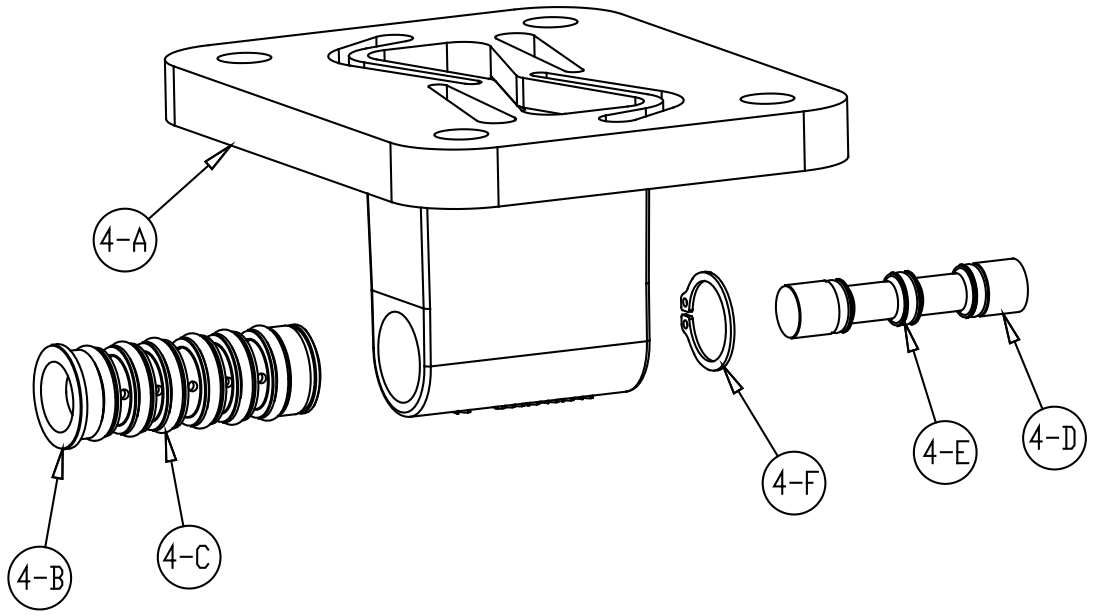
Read these instructions completely, before installation and start-up. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.

Insert the diaphragm/rod assembly into the pump and install the outer chamber. Turn the pump over and thread the second diaphragm / inner plate onto the diaphragm rod. Turn the diaphragm until the inner plate contacts the rod and hand tighten the assembly. Continue tightening until the bolt holes align with the inner chamber holes. DO NOT LEAVE THE ASSEMBLY LOOSE.

Pilot Valve Servicing, Assembly Drawing & Parts List

PILOT VALVE ASSEMBLY PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QTY
4	095-110-558	Pilot Valve Assembly	1
4-A	095-095-558	Valve Body	1
4-B	755-052-000	Sleeve (With O-rings)	1
4-C	560-033-360	O-ring (Sleeve)	6
4-D	775-055-000	Spool (With O-rings)	1
4-E	560-023-360	O-ring (Spool)	3
4-F	675-037-080	Retaining Ring	1



PILOT VALVE SERVICING

To service the pilot valve first shut off the compressed air supply, bleed the pressure from the pump, and disconnect the air supply line from the pump.

STEP #1: See pump assembly drawing.

Using a 1/2" wrench or socket, remove the four capscrews (item 10). Remove the air inlet cap (item 7) and air inlet gasket (item 23). The pilot valve assembly (item 2) can now be removed for inspection and service.

STEP #2: Disassembly of the pilot valve.

Remove the pilot valve spool (item 4-D). Wipe clean and inspect spool and o-rings for dirt, cuts or wear. Replace the o-rings and spool if necessary.

Remove the retaining ring (item 4-F) from the end of the sleeve (item 4-B) and remove the sleeve from the valve body (item 4-A). Wipe clean and inspect sleeve and o-rings for dirt, cuts or wear. Replace the o-rings and sleeve if necessary.

STEP #3: Re-assembly of the pilot valve.

Generously lubricate outside diameter of the sleeve and o-rings. Then carefully insert sleeve into valve body. Take CAUTION when inserting sleeve, not to shear any o-rings. Install retaining ring to sleeve. Generously lubricate outside diameter of spool and o-rings. Then carefully insert spool into sleeve. Take CAUTION when inserting spool, not to shear any o-rings. Use BP-LS-EP-2 multipurpose grease, or equivalent.

STEP #4: Re-install the pilot valve assembly into the intermediate.

Be careful to align the ends of the pilot valve stem between the plunger pins when inserting the pilot valve into the cavity of the intermediate.

Re-install the gasket, air inlet cap and capscrews. Connect the air supply to the pump. The pump is now ready for operation.

PUMPING HAZARDOUS LIQUIDS

When a diaphragm fails, the pumped liquid or fumes enter the air end of the pump. Fumes are exhausted into the surrounding environment. When pumping hazardous or toxic materials, the exhaust air must be piped to an appropriate area for safe disposal. See illustration #1 at right.

This pump can be submerged if the pump materials of construction are compatible with the liquid being pumped. The air exhaust must be piped above the liquid level. See illustration #2 at right. Piping used for the air exhaust must not be smaller than 1" (2.54 cm) diameter. Reducing the pipe size will restrict air flow and reduce pump performance. When the pumped product source is at a higher level than the pump (flooded suction condition), pipe the exhaust higher than the product source to prevent siphoning spills. See illustration #3 at right.

CONVERTING THE PUMP FOR PIPING THE EXHAUST AIR

The following steps are necessary to convert the pump to pipe the exhaust air away from the pump.

Use a #8 Torx or flat screwdriver to remove the six self-tapping screws (item 1-J).

Remove the muffler cap and muffler (items 1-D and 1-F). The 1" NPT molded threads in the air distribution valve body (item 1-B).

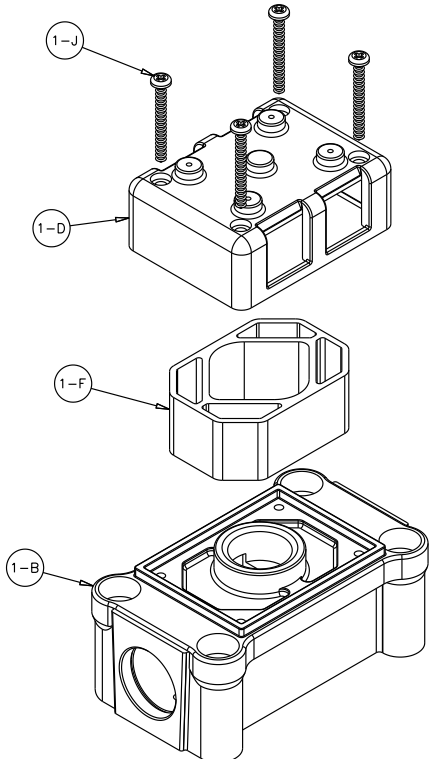
Piping or hose may now be installed.

IMPORTANT INSTALLATION

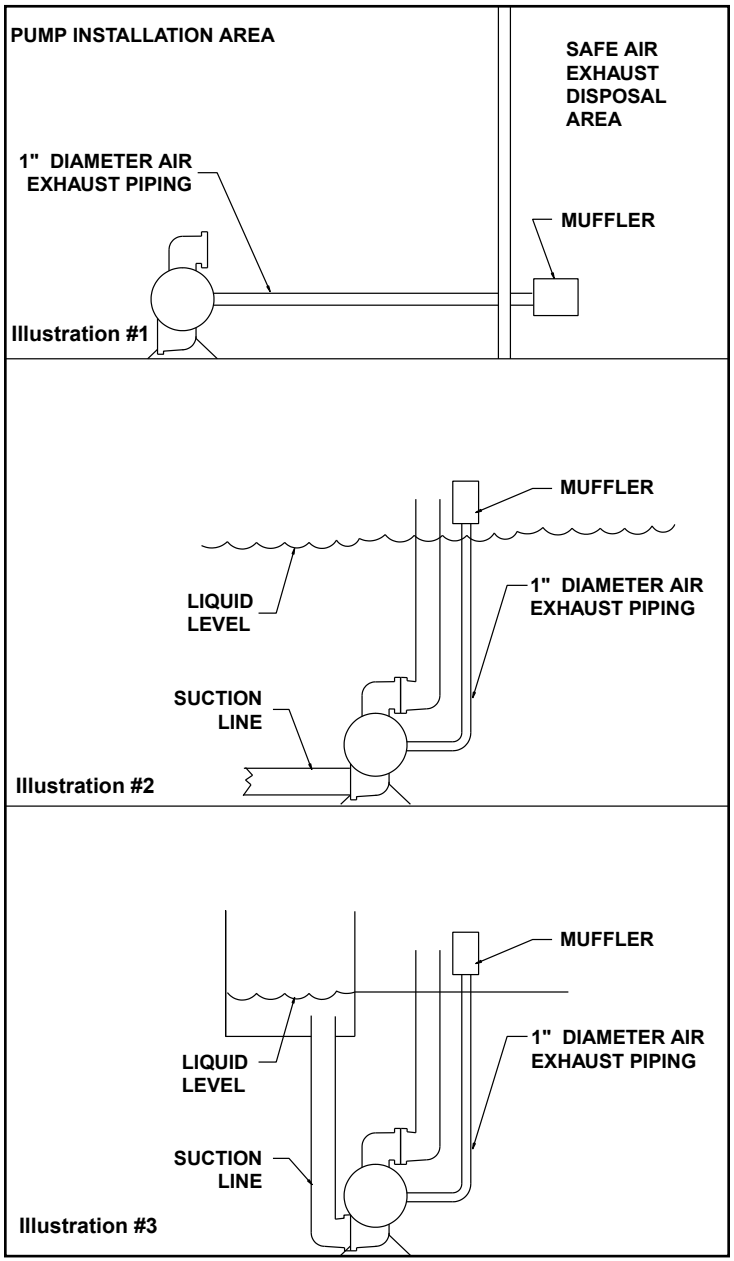
NOTE: The manufacturer recommends installing a flexible hose or connection between the pump and any rigid plumbing. This reduces stresses on the molded plastic threads of the air exhaust port. Failure to do so may result in damage to the air distribution valve body.

Any piping or hose connected to the pump's air exhaust port must be physically supported. Failure to support these connections could also result in damage to the air distribution valve body.

Exhaust Conversion Drawing



CONVERTED EXHAUST ILLUSTRATION



MODULAR CHECK VALVE SERVICING

Before servicing the check valves, first shut off the suction line and then the discharge line to the pump. Next, shut off the compressed air supply, bleed air pressure from the pump, and disconnect the air supply line from the pump. Drain any remaining fluid from the pump. The pump can now be removed for service.

To access the modular check valve, remove the elbows (items 19 & 20 from pump composite repair parts drawing). Use a $^{9}/_{16}$" wrench or socket to remove the fasteners. Once the elbows are removed, the modular check valves can be seen in the cavities of the outer chamber (items 16).

Next remove the check valve seal (item 37). Inspect the seal for cuts or pinched areas. Replace seal as needed.

Disassemble the component parts of each modular check valve. Inspect the check valve retainer (item 32) for cuts, abrasive wear, or embedded materials. Replace as needed.

Inspect the check balls (items 3) for wear, abrasion, or cuts on the spherical surface. The check valve seats (items 38) should be inspected for cuts, abrasive wear, or embedded material on the surfaces of both the external and internal chamfers. The spherical surface of the check balls must seat flush to the surface of the inner chamfer on the check valve seats for the pump to operate to peak efficiency. Replace any worn or damaged parts as necessary.

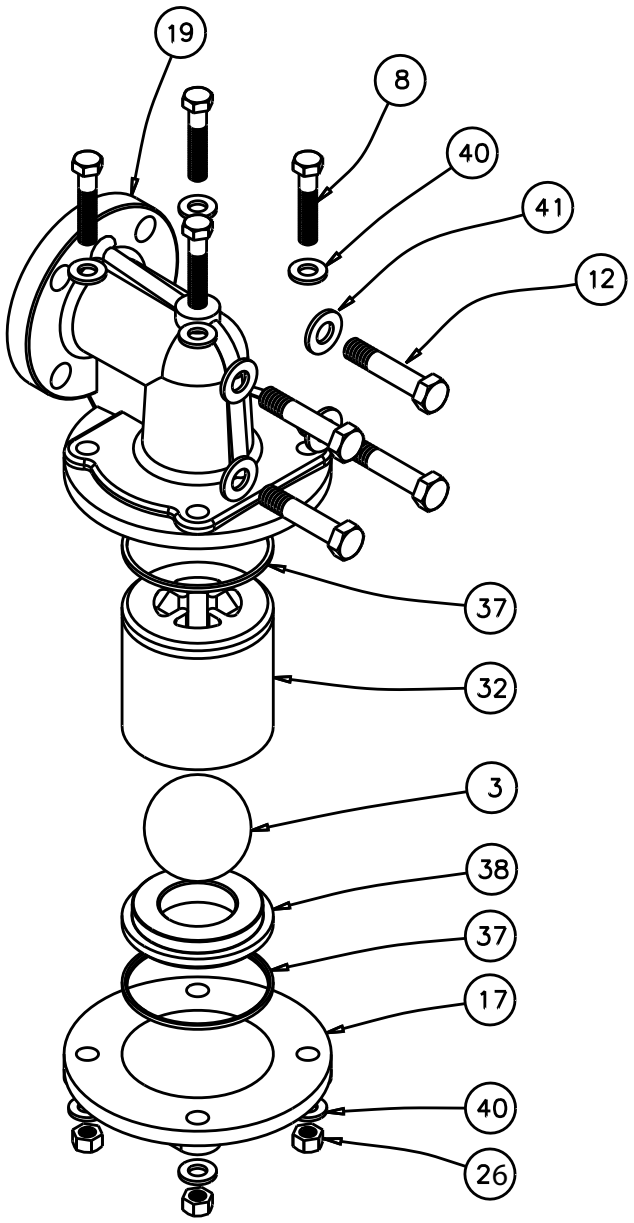
Remove the remaining check valve seal (item 37). Inspect the seal for cuts or pinched areas. Replace seal as needed.

Re-assemble the modular check valve. The seat should fit snugly into the retainer.

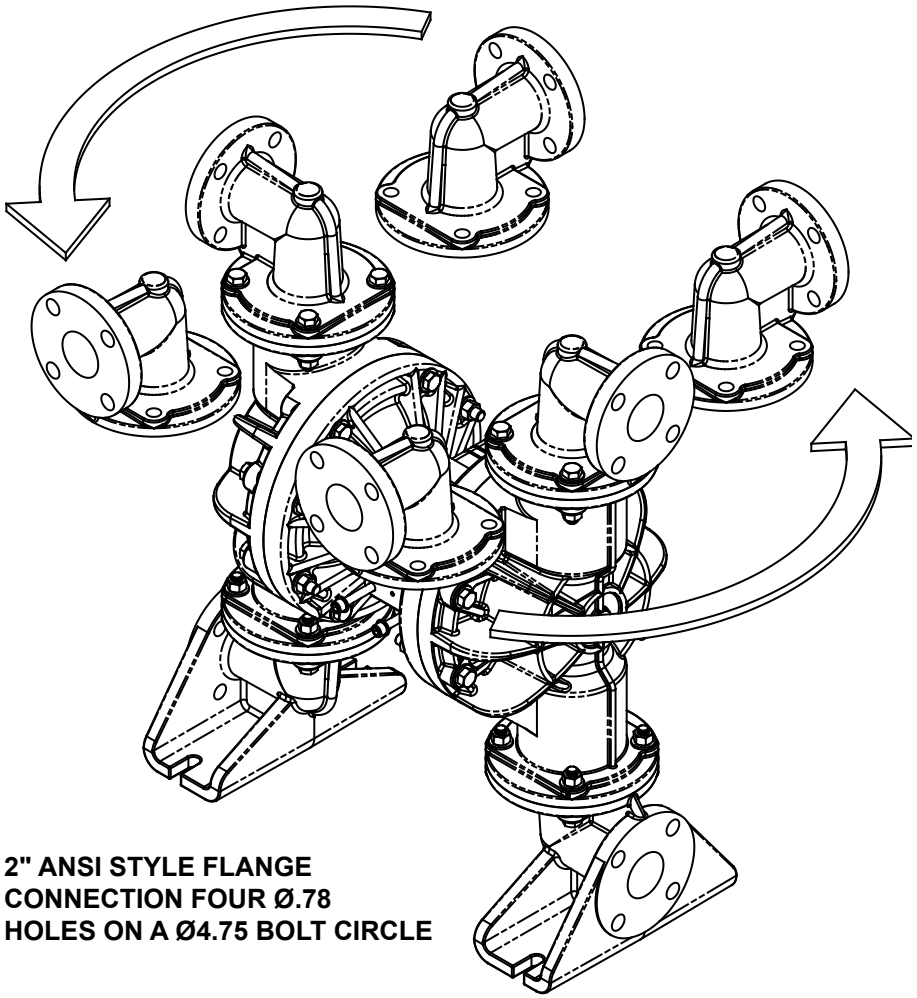
Place a check valve seal (item 37) into the cavity of the outer chamber (item 17). Make sure the chamfer side of the seal faces out. Insert the modular check valve into the outer chamber with the retainer facing up. Install a check valve seal (item 37). Make sure the chamfer side of the seal faces the chamfer on the check valve seat or retainer.

The pump can now reassembled, reconnected and returned to operation.

Modular Check Valve Drawing



Dual Port Option Drawing



2" ANSI STYLE FLANGE CONNECTION FOUR Ø.78 HOLES ON A Ø4.75 BOLT CIRCLE

DUAL PORTING OPTIONS

Several dual porting options are possible. The pump can be converted to a dual port arrangement on both the suction and the discharge ends. The porting can be configured to a single suction and a dual discharge. The porting can be changed to a dual suction and a single discharge.

The above changes are possible because the porting flange of the elbows are designed to mate with a 2" ANSI Flange Connection.

DUAL PORTING OF BOTH SUCTION AND DISCHARGE ENDS OF THE PUMP

Converting the pump from the standard single suction and discharge porting configuration to dual porting at each end is easy. Simply remove the manifold seals and manifolds from the pump.

The discharge elbows can be rotated in 90°increments and the suction elbows can be rotated in 180° increments (see optional positioning in the Dual Porting Drawing).

SINGLE PORTING OF THE SUCTION AND DUAL PORTING OF THE PUMP DISCHARGE

To convert the pump from the standard single suction and single discharge porting configuration to a dual discharge porting arrangement remove the only the discharge manifolds and manifold seals. Position the discharge elbows in the desired direction at 90° increments. (See arrows and optional positioning in the Dual Porting Drawing.)

DUAL PORTING OF THE SUCTION AND SINGLE PORTING OF THE PUMP DISCHARGE

To convert the pump from the standard single suction and single discharge porting configuration to a dual suction porting arrangement remove the only the suction (bottom) manifolds and manifold seals.

Position the suction elbows in the desired direction at 180° increments. (See arrows and optional positioning in the Dual Porting Drawing.)

Leak Detection Options Drawing

LEAK DETECTION OPTION (ELECTRONIC)

Follow instructions found elsewhere in this manual, “Filling the Spill Prevention Chambers” when installing leak detectors.

Electronic Leak Detector Installation

Kit 032-037-000	100VAC	50Hz
	or 110-120VAC	50/60Hz
	or 220-240VAC	50/60Hz
Kit 032-045-000	12-32VDC	

To install electronic leak detectors, remove the bottom ¼" NPT pipe plug on the visual sight tube (item 50). Insert leak detector into the ¼" pipe tee (item 53).

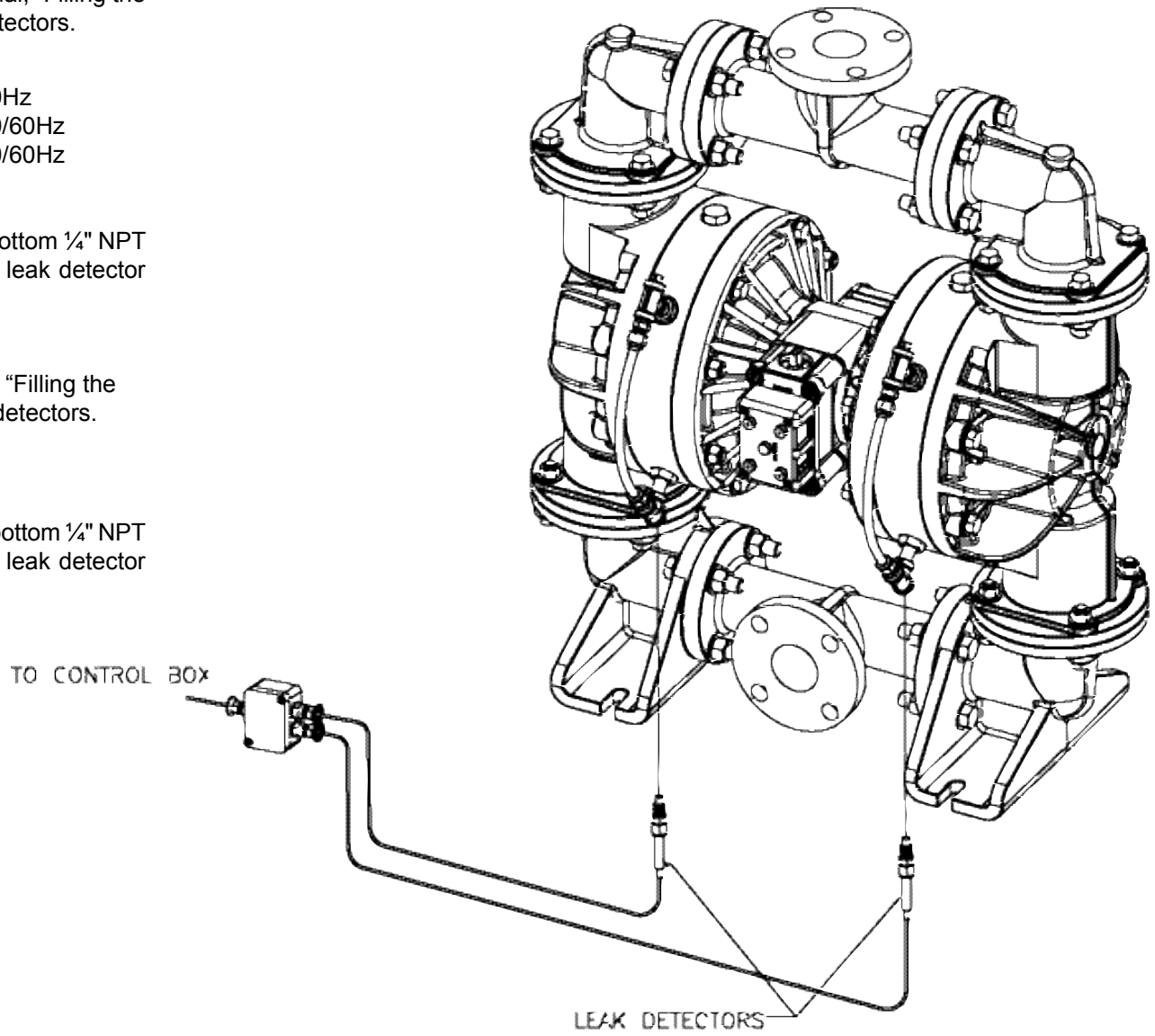
LEAK DETECTION OPTION (MECHANICAL)

Follow instructions found elsewhere in this manual, “Filling the Spill Containment Chambers” when installing leak detectors.

Mechanical Leak Detector Installation

Kit 031-023-110

To install mechanical leak detectors, remove the bottom ¼" NPT pipe plug on the visual sight tube (item 50). Insert leak detector into the ¼" pipe tee (item 53).



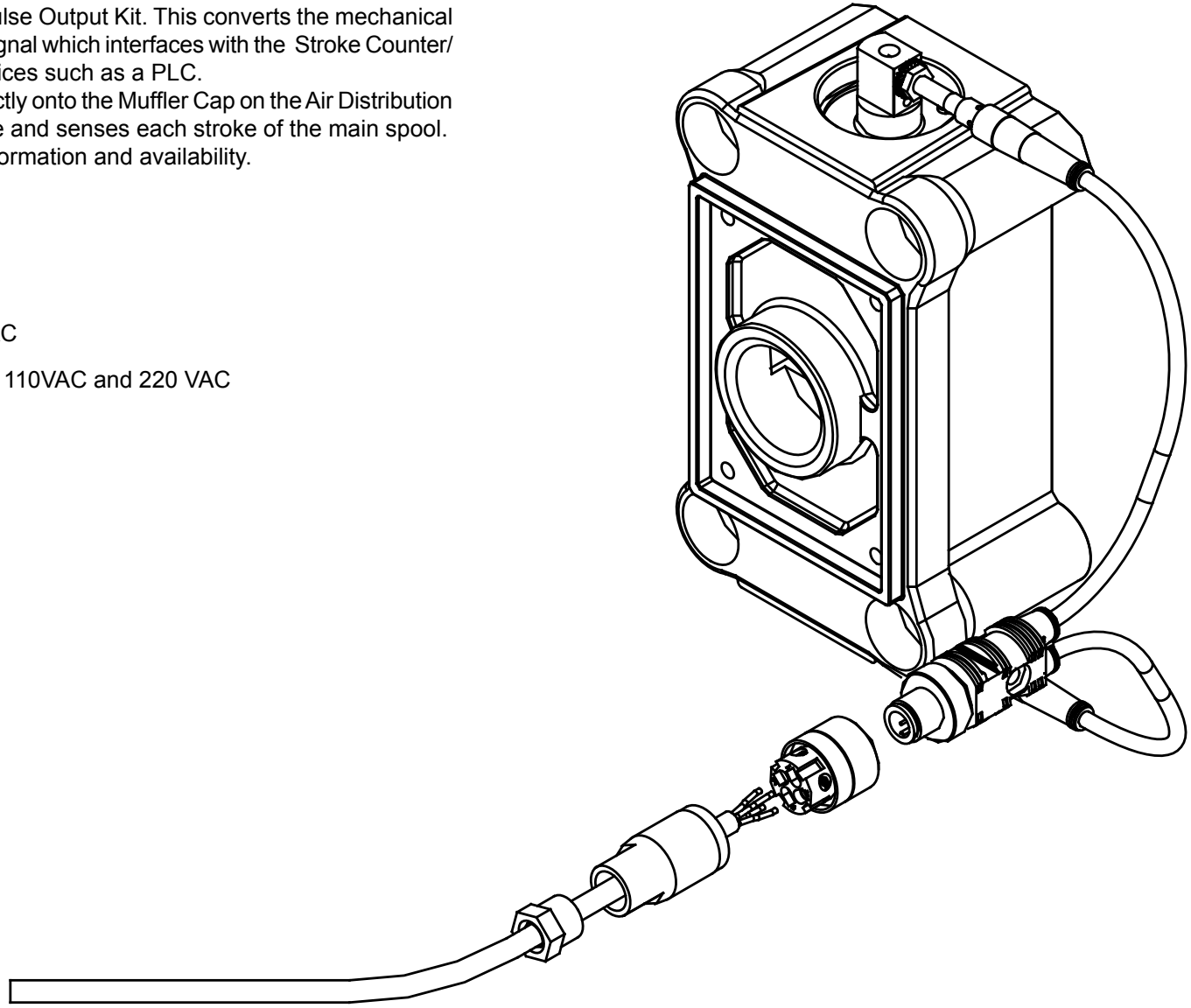
Pulse Output Kit Drawing

PULSE OUTPUT KIT OPTION

This pump can be fitted with a Pulse Output Kit. This converts the mechanical strokes of the pump to an electrical signal which interfaces with the Stroke Counter/ Batch Controller or user control devices such as a PLC.

The Pulse Output Kits mount directly onto the Muffler Cap on the Air Distribution Valve Assembly or onto the air valve and senses each stroke of the main spool.

Consult the factory for further information and availability.



Pulse Output Kits

475-244-001	10-30 VDC
475-244-002	110/220 VAC
475-244-003	10-30VDC, 110VAC and 220 VAC

Optional Muffler Configurations, Drawing

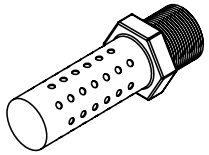
OPTION 0
530-028-550 Encapsulated Muffler uses (1) Cap and (4) 710-015-115 Self Tapping Screw to hold it in place.

OPTION 1
530-027-000 Sound Dampening Muffler screws directly into the Air Valve body. This muffler is equipped with a porous plastic element.

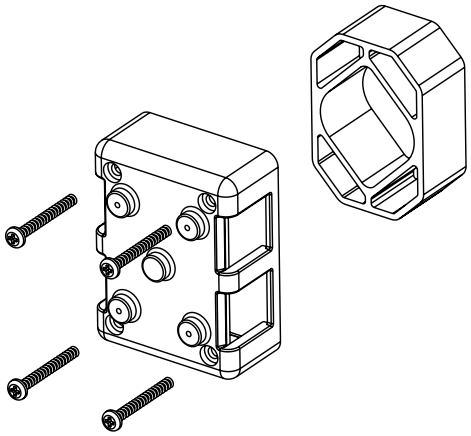
OPTION 2
530-010-000 Mesh Muffler screws directly into the Air Valve Body. This muffler is equipped with a metal element.

OPTION 6
530-033-000 Metal Muffler screws directly into the Air Body.

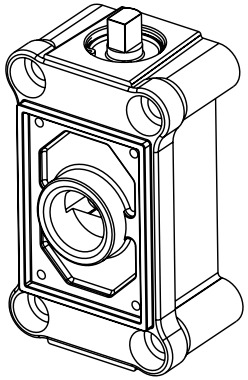
ATEX Compliant

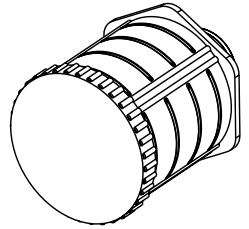


Option 6



Option 0

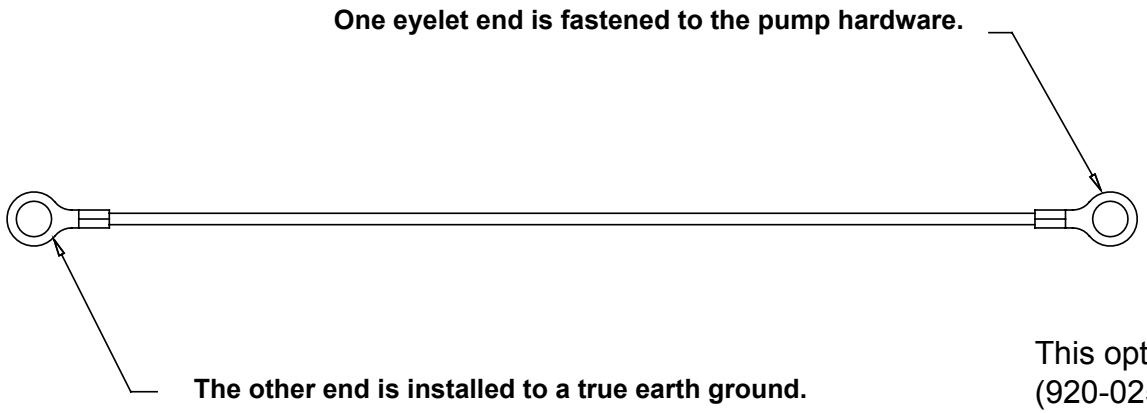


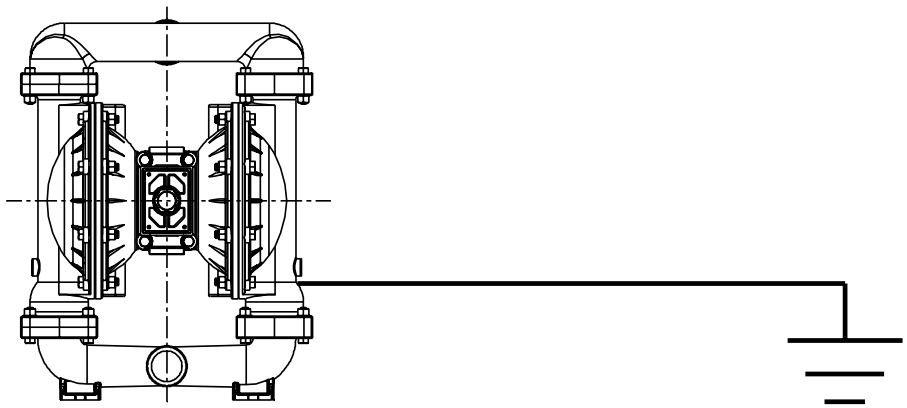


Option 1 and 2

Grounding The Pump

To be fully groundable, the pumps must be ATEX Compliant. Refer to pump data sheet for ordering.





This optional 8 foot long (244 centimeters) Ground Strap (920-025-000) is available for easy ground connection.

To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required.

WARNING

Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.

WARREN RUPP®

Declaration of Conformity

Manufacturer: Warren Rupp, Inc.®, 800 N. Main Street, P.O. Box 1568, Mansfield, Ohio, 44901-1568 USA

Certifies that Air-Operated Double Diaphragm Pump Series: HDB, HDF, M Non-Metallic, S Non-Metallic, M Metallic, S Metallic, T Series, G Series, U Series, EH and SH High Pressure, RS Series, W Series, SMA and SPA Submersibles, and Tranquilizer Surge Suppressors comply with the European Community Directive 2006/42/EC on Machinery, according to Annex VIII. This product has used Harmonized Standard EN 809, Pumps and Pump Units for Liquids - Common Safety Requirements, to verify conformance.

David Roseberry
Signature of authorized person

October 20, 2005
Date of issue

David Roseberry
Printed name of authorized person

Engineering Manager
Title

Revision Level: E

May 27, 2010
Date of revision

CE

IDEX FLUID & METERING

Declaration of Conformity
Declaration of Conformity

Declaration of Conformity

WARREN RUPP®

EC Declaration of Conformity

In accordance with ATEX Directive 94/9/EC,
Equipment intended for use in potentially explosive environments.

Manufacturer: Warren Rupp, Inc.®, A Unit of IDEX Corportion
800 North Main Street, P.O. Box 1568, Mansfield, OH 44901-1568 USA

EN 60079-25: 2004
For pumps equipped with Pulse Output ATEX Option
KEMA Quality B.V. (0344)

Applicable Standard:
EN13463-1: 2001,
EN13463-5: 2003

AODD Pumps and Surge Suppressors
For Type Examination Designations, see page 2 (back)

AODD (Air-Operated Double Diaphragm) Pumps
EC Type Examination Certificate No. Pumps: KEMA 09ATEX0071 X
KEMA Quality B.V.
Utrechtseweg 310
6812 AR Arnhem, The Netherlands

SANDPIPER® A WARREN RUPP PUMP BRAND **Tranquilizer®**

IDEX FLUID & METERING

DATE/APPROVAL/TITLE:
27 MAY 2010

David Roseberry
David Roseberry, Engineering Manager

Declaration of Conformity

WARREN RUPP®

EC Declaration of Conformity

ATEX Summary of Markings

Type	Marking			Listed In	Non-Conductive Fluids
Pump types, S1F, S15, S20, and S30 provided with the pulse output option		II 2 G Ex ia c IIC T5 II 3/2 G Ex ia c IIC T5 II 2 D Ex c iaD 20 IP67 T100°C	KEMA 09ATEX0071 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X	No Yes Yes
Pump types, S1F, S15, S20, and S30 provided with the integral solenoid option		II 2 G EEx m c II T5 II 3/2 G EEx m c II T5 II 2 D c IP65 T100°C	KEMA 09ATEX0071 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X	No Yes Yes
Pump types, HDB1½, HDB40, HDB2, HDB50, HDB3, HDF1, HDF25, HDF2, HDF3M, PB¼, S05, S1F, S15, S20, S30, SB1, SB25, ST1½, ST40, G15, G20, and G30, without the above listed options, no aluminum parts		II 1 G c T5 II 3/1 G c T5 II 1 D c T100°C I M1 c I M2 c	KEMA 09ATEX0071 X KEMA 09ATEX0072 X CE 0344	KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0071 X KEMA 09ATEX0072 X	No Yes Yes No Yes
Pump types, DMF2, DMF3, HDB1½, HDB40, HDB2, HDB50, HDB3, HDF1, HDF25, HDF2, HDF3M, PB¼, S05, S1F, S15, S20, S30, SB1, SB25, SE½, ST1, ST25, ST1½, ST40, U1F, G05, G1F, G15, G20, and G30		II 2 G c T5 II 3/2 G c T5 II 2 D c T100°C	KEMA 09ATEX0072 X CE	KEMA 09ATEX0072 X KEMA 09ATEX0072 X KEMA 09ATEX0072 X	No Yes Yes
Surge Suppressors all types		II 2 G T5 II 3/2 G T5 II 2 D T100°C	KEMA 09ATEX0073 CE	KEMA 09ATEX0073 KEMA 09ATEX0073 KEMA 09ATEX0073	No Yes Yes

EC Type Certificate No. Pumps: KEMA 09ATEX0071 X
Type Certificate No. Pumps: KEMA 09ATEX0072 X
Type Certificate No. Suppressors: KEMA 09ATEX0073

IDEX FLUID & METERING

Declaration of Conformity